A

BRIEF COMPENDIUM

OF

ARITHMETIC.

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ARITHMETIC,

ILLUSTRATED BY

CONCISE AND EASY RULES,

ARRANGED AFTER A NEW METHOD,

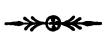
And exemplified by Exercises, adapted, with especial attention, to the capacities of Junior Pupils.

WITH AN APPENDIX,

CONTAINING

SHORT METHODS OF RECKONING,

INTENDED AS EXERCISES FOR MENTAL CALCULATION.



" Plus habet in sensu, quam in fronte promittit."

QUINTILIAN.

BY BENJAMIN SNOWDEN.

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PREFACE.

IN the course of more than fifty years devoted to the instruction of youth, in Languages and Mathematics, the author of this Compendium, has had frequent occasion to remark on the merits, deficiencies, and defects of various books intended for the use of schools.

Of systems of Arithmetic, there are many deserving of high commendation. There seems, however, to the author, yet to be wanting, a cheap compendium of short clear rules and easy examples, for the use of junior pupils of both sexes.

For this purpose, and to serve as an introduction to large treatises the author has endeavoured to simplify all the rules, to render them concise without obscurity, and intelligible without being too prolix. But, as *Iter est breve per exempla*, he has adapted to each rule, examples so contrived as not only, not to prevent, as long questions do, the requisite constant exercise of multiplication and division; but to accelerate the progress of the little Tyro in his road to acquire habits of quick and accurate calculation. The work also of many examples is given, in full, where the rules, on the first reading, may not seem easy to be understood.

The table of contents shows, that the author differs from others, in respect to the arrangement of some of the rules. For reasons obvious to the tutor, Multiplication comes close after Addition, then Subtraction and Division. Fellowship, Barter, Loss and Gain, and Alligation, follow immediately after the Rule of Three, of which indeed they are little more than exemplifications. By thus classing these five rules, the principle of proportion is kept in view, and the pupil will be led to consider the four last rules as being connected with the Rule of Three, and as only additional exercises on it and the preceding rules.

The principle of the Rules of Practice is explained in a copious manner by precepts, and by examples wrought out in full; and is applied to Tare and Tret, Interest, Commission, Insurance, Brokerage, and Exchanges. The latter Rule is treated of very briefly and the examples are few, but the author supposes quite sufficient to exercise a junior pupil. For, although the places, between which and London, exchanges are negotiated, are numerous, and continually increase; the methods of calculation are however always the same, by the Rule of Three or by means of aliquot parts. Connected with the rules of Practice, and grounded upon them, are the short methods of reckoning introduced in the appendix, useful and easy as mental exercises, when the quantity does not exceed 400.

Vulgar Fractions, a part of Arithmetic, so abstract, that junior pupils seldom well comprehend their nature, are here taught in a manner different from that of other authors. The 1st. problem shows how a vulgar fraction is produced by the reduction of a given quantity to the

fraction of its integer; and, that the pupil may, at once, have a clear idea of the nature of the fractional expression, it is left without reduction to its least terms. The problem for reducing fractions to a common denominator, is here placed last in reduction; and, by its immediate proximity to Addition, will, the author presumes, render the rationale of this part of Arithmetic less difficult to be comprehended.

Circulating decimals and contractions of decimal operations are here omitted, to obtain space for more useful matter. For further exercises in decimals, a short table of compound interest is given, and another for the valuation of annuities for ages between 51 and 80. Duodecimals complete the business of the three kinds of fractions usually taught.

Involution, with a table of Powers, and Evolution follow in order. The Rules of Trial and Error are briefly introduced, as are Arithmetical and Geometrical Progression. By means of the short rules to the two Problems in the latter, the examples are made much more easy of solution, than by the long rules and directions given by DILWORTH, and other authors.

The author has purposely avoided to place under any rule, examples that require the management of large numbers, and has not inserted among the miscellaneous examples, any that may not be solved by the rules in this compendium. He has also omitted long operations or such as have reference to statistics or experimental philosophy, with which some books abound. Such exercises may be very proper for studious senior pupils, but as every experienced tutor knows, they are formidable obstacles in the way of the junior Tyro, while endeavouring to become an expert and correct arithmetician.

The tutor may perhaps find, that for some pupils there are too few examples to the first rules. As the paper is good, additional figures may be written to supply deficiencies.—As one of the factors, for the multiplications both of whole numbers and decimals, is always divisible by 9, the truth of the products from such factors may easily be known.—The short rule, page 88, for interest at 6 per Cent., is thus discovered. Let P $=$ the Principal, M $=$ the Months, R $=$ the Ratio, ·06. Then P R $\times \frac{M}{12} =$ the Interest in pounds; in shillings, 20 P R $\times \frac{M}{12}$; which reduced, is P M $\times$ ·1 or $\frac{PM}{10}$, the Rule.

In instructing a class, the directions for the examples to the first rules given, *viva voce*, by a monitor, may be used with much effect. In a short time the whole book may be learned, and its principal parts transcribed, by an industrious pupil of ordinary capacity. BONNYCASTLE, KEITH, or some other scientific work, may then follow, with advantage; and, the author presumes, may be studied with greater success after the use of this easy introduction. But such authors have also a claim to the attention of youth, as they approach to mature years. It is, however, to be regretted, that Arithmetic, replete as it is, with utility and rational entertainment, should be almost quite disregarded after the completion of school instruction. Perhaps one cause of this disregard, is the dislike originally occasioned, by the injudicious, and too early, use of books, containing rules and examples too difficult for the exercise of juvenile capacities.

ARITHMETIC.

ARITHMETIC teaches how to compute by means of these ten Figures, 1, 2, 3, 4, 5, 6, 7, 8, 9, 0.

The fundamental rules are NOTATION, NUMERATION, ADDITION, MULTIPLICATION, SUBTRACTION, & DIVISION.

Notation teaches how to express Numbers in Figures; Numeration how to read and write them.

TABLE.

Millions.	Thousands.	Hundreds.	Tens.	Units.	To be read thus—
				9	9
			8	6	86
		7	5	4	754
	4	3	6	5	4 THOUSANDS, 365
	59	8	7	3	59 THOUSANDS, 873
869	4	6	7		869 THOUSANDS, 467
4	754	7	9	8	4 MILLIONS, 754 THOUSANDS, 798
23	582	4	6	2	23 MILLIONS, 582 THOUSANDS, 462
825	687	6	4	9	825 MILLIONS, 687 THOUSANDS, 649

NOTATION.

Observe carefully how the Numbers are divided by Commas in the Table.

Express in Figures,

Fifty-nine thousand eight hundred and seventy-three. Eight hundred and twenty-five millions six hundred thousand. Four millions and eight. Eight hundred millions and eleven.

NUMERATION.

Point off the numbers by means of Commas as in the Table.

Read and Write the following Numbers:

87680.—67100.—507009.—1687041.—94807.—09467
80000900.

ADDITION OF INTEGERS.

Addition teaches how to find the sum or total of several numbers. The Addition Table must be learned by heart.

RULE.—Place units under units, tens under tens, hundreds under hundreds, &c., draw a line, and observe the manner of doing the second of the following examples :—

	6	7394	84	1954	6
			765	7	1457
	7	274		98	
	8	65	9		78649
	9	4	1278	678	9738
	5	8474	89	4759	8945
Total.		16,211			
Part.		8,817			
Proof.		16,211			

The sum of the figures in the right hand column is 21, write 1 and carry the 2 for tens to the 7 in the next column, of which the sum will be 31; write 1 and carry 3 for tens to the 4 in the next column, and the sum will be 12; set down 2 and carry 1 to the remaining left hand figures, and their sum will be 16.

PROOF.—Divide the example into two parts by means of a line; add the figures below the line together; then add this part and the upper part together, and the sum of the two parts, if each line of the work be right, will be the same as the total.

Examples.

Add 647, 9678, 49678, 87, and 974 together.

What is the sum of 3789, 97167849, 876, and 28?

Write seven lines of the number 905769 and find their sum.

Find the sum of nine lines of the number 678950847.

MULTIPLICATION.

Multiplication is a short method of adding a number to itself, any number of times. Two numbers, called factors, are always given to find a third.

1. The Multiplicand, or number to be multiplied.
2. The Multiplier.

The Third is called the Product.

The Table must be learned by heart.

RULE 1.—In multiplying, carry one for every ten, as in Addition.

Multiply	678950847
By	2

Multiply the same Multiplicand separately by 3, 4, 5, 6, 7, 8, 9, 10, 11, 12.

RULE 2.—When the Multiplier consists of several figures, multiply every figure of the Multiplicand, by each figure of the Multiplier, taking care to place the first figure of each line under its Multiplier. Add all the lines of products together, and their sum will be the total. Proof.—Multiply the Multiplier by the Multiplicand.

Observe, for = read equal to.

Examples.

Multiply	729		839	678549	87659
By	839		729	6075	87390
	6561 =	9 times 729	7551		
	* 21870 =	30 729	1678		
	* 583200 =	800 729	5873		
Product	611631 =	839 729	611631	Proof.	

* The ciphers in such products may be omitted; here, they are put only for explanation.

407835	176009	896490	378009
60950	45072	79560	607491

Multiply	69876 by 90780	70047 by 47089
	98407 by 547830	96008 by 57609
	67068 by 47000	8064 by 89000

RULE 2.—When the Multiplier is the product of two numbers in the table, multiply by one of them and the product by the other.

Examples.

Multiply 195084 by 14, and the same Multiplicand separately by 16, 18, 21, 49, 72, 108, and 144.

SUBTRACTION.

Subtraction teacheth to take a less number from a greater, to find the remainder or difference.

RULE.—Place the less number under the greater, units under units, tens under tens, &c. Begin at the right hand figure and subtract it from the figure above it, and continue from right to left. Add the remainder to the number subtracted, and, the sum, if the work be right, will be the same as the upper line.

From	706954068239
Subtract	103621023214
Remainder	603333045025
Proof	706954068239

OBSERVE.—When the under figure is less than the upper one, add ten to the latter, and from their sum subtract the under figure, carrying one to the next figure to be subtracted.

From	820682057	467869	27100672
Subtract	166792168	16873	1216789
Remainder	653889889	450996	
Proof	820682057	467869	

From 71867000 subtract 87614.

Take 876 out of 3786, and then out of the remainder as often as you can.

How often may 796 be taken out of 7864 ?

Subtract 17816 from 127658 as often as you can.

DIVISION.

Division is a short method of performing several subtractions, and finds how often one number may be taken out of another, or is contained in it. Two numbers are always given to find a third.

1. The Dividend, or number to be divided.
2. The Divisor.

The third, or number to be found, is called the Quotient, and shews how often the Divisor may be subtracted from the Dividend, or how many times it is contained in it.

RULE 1.—Place the Divisor and Dividend as in the following examples, and observe the manner of working them. Proof.—Multiply the Quotient by the Divisor, or the Divisor by the Quotient; and to the Product, add the remainder, the sum will be the same as the Dividend if the work be right.

Divisor.	Dividend.	Quotient.
7)	1678	(239$\frac{5}{7}$
	14	7
	27	Proof 1678
	21	
	68	
	63	
Remainder	5	

Divisor.	Dividend.	Quotient.
876)	3786	(4$\frac{2}{8}\frac{8}{7}\frac{2}{6}$
	3504	
Remainder	282	Multiply 876
		By 4
		Product 3504
		Add 282
		Proof 3786

Divisor.	Dividend.	Quotient.
796)	786414	(987
	7164	
	7001	
	6368	
	6334	
	5572	
	762	

	987
	By 796
Product	785652
Add	762
Proof	786414

The figures in the Quotient of the first example are found thus; say, how often 7 in 16, the answer is twice, put 2 in the Quotient, and 14 for twice 7, under 16 and subtract; to the remainder bring 7 from the Dividend. Then say how often 7 in 27, the answer is 3 times, write 3 in the Quotient, and 21 for 3 times 7, under 27 and subtract; to the remainder annex the 8, the next figure of the Dividend, and for 68 proceed as has been explained. The Quotient shows that 7 may be taken 239 times from 1678. Whenever there is a remainder, place it after the Quotient above a line, and the Divisor under it thus, $\frac{5}{7}$.

Examples.

Divisors.	Dividends.	Quotients.	Divisors.	Dividends.	Quotients.
6	) 4578614 (		72	) 1967841 (	
9	) 1978614 (		279	) 1276136 (	
11	) 16784127 (		873	) 61678497 (	
12	) 10286136 (		3789	) 16786747 (	
18	) 3768462 (		8946	) 989876412 (	

RULE 2.—When the Divisor is less than 13, ask how often it may be had in the first figure or figures on the left; set the Quotient under the figure or figures taken; and when there is a remainder, suppose it to be placed before the next right hand figure, then ask again and thus proceed through the Dividend.

Examples.

	3)56103961	4)52019675	5)1370192
Quotient	18701320$\frac{1}{3}$		

In the same manner divide the last number by 10, 11, 12, 6, 7, 8, and 9.

RULE 3.—When the Divisor has ciphers on the right hand, cut them off; also cut off as many figures from the right hand of the Dividend, and divide by the left hand figure or figures of the Divisor.

Examples.

2,0)17864,8	12,00)1068764,76

Divide 147683796 by 8700.

What is the Quotient of 37167896 by 950000?

ADDITION OF MONEY.

These Tables must be learned by heart.

Observe.—¼—stands for Farthing. ½—for Halfpenny. ¾—for three Farthings.
s.—for Shillings. d.—for Pence. £.—for Pounds.

Farthings		*Pence.*				*Shillings.*					
f.	d.	d.	s.	d.	s. d.	s.	£.	s.	s.	£.	s.
4	are 1	12	are 1	20	are 1 8	20	are 1	0	115	are 5	15
6	„ 1½	24	„ 2	30	„ 2 6	30	„ 1	10	120	„ 6	0
8	„ 2	36	„ 3	40	„ 3 4	40	„ 2	0	127	„ 6	7
12	„ 3	48	„ 4	50	„ 4 2	50	„ 2	10	130	„ 6	10
14	„ 3½	60	„ 5	60	„ 5 0	60	„ 3	0	140	„ 7	0
16	„ 4	72	„ 6	70	„ 5 10	70	„ 3	10	147	„ 7	7
20	„ 5	84	„ 7	80	„ 6 8	80	„ 4	0	150	„ 7	10
23	„ 5¾	96	„ 8	90	„ 7 6	85	„ 4	5	160	„ 8	0
26	„ 6½	108	„ 9	100	„ 8 4	90	„ 4	10	170	„ 8	10
28	„ 7	120	„ 10	110	„ 9 2	97	„ 4	17	180	„ 9	0
30	„ 7½	132	„ 11	115	„ 9 7	100	„ 5	0	190	„ 9	10
32	„ 8	144	„ 12	126	„ 10 6	110	„ 5	10	200	„ 10	0
36	„ 9	156	„ 13	140	„ 11 8	112	„ 5	12	220	„ 11	0

RULE.—Place Farthings under Farthings, Pence under Pence, Shillings under Shillings, Pounds under Pounds; and be careful to put Units under Units, Tens under Tens, &c. Add the Farthings together, and always finding from the Table, or from memory, how many Pence are in the Farthings, how many Shillings in the Pence, how many Pounds in the Shillings, proceed as is shown in doing the first of the following example:

	£.	s.	d.	f.	d.	s.	d.	£.	s.	d.
	4	16	7¼	¼	2¼	4	3¼	67	14	3¼
				½	1½	5	6¾	276	16	4
	75	8	11¾	¾	6¾	7	8¼	8	14	6¼
	4	17	6¼	¼	7¼	8	6½	12	16	7¾
	2	3	9¼	¾	6¼	9	5	6	17	9¾
Total	87	6	10¾	½	1½	7	2¾	4	16	1
Part	82	10	3¼							
Proof	87	6	10¾							

Here the sum of the Farthings is 7, or 1¾d; set down ¾ and carry 1 to the Pence, and the sum will be 34d., or 2s. 10d., the 10d. is set down, and 2s. are carried to the

3s., which, with the 7, 8, and 6, make 26 and 10 are 36 and 10 are 46s. or £2 6s., set down the 6s. and carry £2 to the Pounds, and the sum of them will be 87; whence the total is £87 6s. 10d. Proof.—Rule the upper line off, and add the lines of the remaining part together; this part and the upper line being added together will be the same as the total, if the work be right.

£.	s.	d.	£.	s.	d.	£.	s.	d.
173	15	4¼	379	18	10¾	178	12	6¾
19	8	9	45	10	7½	496	18	9½
378	12	8¾	34	9	1½	787	17	9¾
34	14	10¾	4	17	10¾	365	18	10½
71	13	8½	712	7	8½	414	3	9½
145	8	6	39	18	5½	629	16	11¾

What is the sum of £13 10s. 4½d., £2 5s. 3¾d., 7s. 9½d., and £5 16s. 4¾d.?

Find the total of 9½d., 7s. 3¾d., ¾d., 16s., 7½d., £34 14s. 6½d., and £648 16s. 11½d.

Write nine lines of £7 15s. 8¼d., and add them together.

SUBTRACTION OF MONEY.

	£.	s.	£.	s.	£.	s.	d.
From	4142	12	474231	10	67219	12	3¾
Take	101	7	12101	9	4104	12	0¼
Remainder							
Proof							

Rule.—When the lower number is greater than the upper, if it is Farthings add 4 to the upper; if Pence add 12; if Shillings add 20; subtract the lower from the sum, set down the remainder, and forget not to carry one to the next number to be subtracted; or subtract the lower from 4 when Farthings, from 12 when Pence, from 20 when Shillings, and to the remainder add the

upper; then set down the sum of the two, and carry one to the next left hand figure.

		20	12 4									
	£.	s.	d.	£.	s.	d.	£.	s.	d.	£.	s.	d.
	42	7	2¼	7	12	8	5	9	4¼	127	14	8¼
	1	12	7½	2	16	9½	3	11	6¾	42	15	9¾
Remainder	40	14	6¾									

	£.	s.	d.	£.	s.	d.	£.	s.	d.	£.	s.	d.
	194	0	0	376	4	9¼	906	0	0	300	0	0
	29	9	2¼	91	0	11¼	19	19	0¼	9	0	0¼
Difference												

Subtract £4 17s. 1½d. from £17 13s. 4¼d. as often as you can. Remainder is £3 1s. 11¼d.

From £1000 take ¼f.; and from £10000 take ¼f.

What is the difference between £74 16s. 8½d. and £47 19s. 11¼d?

MULTIPLICATION OF MONEY.

Rule 1.—Place the Multiplier under the right hand denomination. Having multiplied the Farthings, find how many Pence there are in them; set down Farthings, if any; carry the Pence to the product of the Pence, find how many Shillings, set down Pence; carry the Shillings to the product of the Shillings; find how many Pounds in the product of Shillings; set down odd Shillings, carry the Pounds and proceed to multiply the Pounds as in multiplication of integers.

Examples.

	£.	s.	d.	£.	s.	d.	£.	s.	£.	s.	d.	£.	s.	d.
Mult.	13	14	9¾	5	12	8	47	13	0	14	7½	0	0	11¼
By			2			3		4			5			11
Product	27	9	7½											

What are the separate products of £7 15s. 8¼d., multiplied by 6, 7, 8, 9, 10, 11, and 12?

RULE 2.—When the Multiplier is above 12 and is the product of two numbers in the table, multiply by one of them, and then by the other.

Remember; = means equal to.

Examples.

Multiply	s.	d.			Multiply	s.	d.		
	5	9¼	by 28			7	11	by 45	
		7					9		
	2	0	4¼	= 7 times		3	11	3	= 9 times
		4					5		
	£8	1	7	= 28 times		£17	16	3	= 45 times

What cost—

	£.	s.	d.		£.	s.	d.		£.	s.	d.
16 Yards at	1	18	0½	*A.*	3	8	8	20 Tons at	4	8	2	*A.*	88	3	4
22 Ditto at	1	1	8	*A.*	23	16	8	55 Tuns at	83	9	6	*A.*	4591	2	6
28 Ditto at	0	19	6	*A.*	27	6	0	77 Pairs at	0	10	8	*A.*	41	1	4

RULE 3.—If the Multiplier is not found in the table, find the nearest next less number to it; then multiply by its factors, and add to the last product so many times the given price as are equal to what is wanting. Or find the nearest next greater number, multiply by its factors, and subtract from the product so many times the given price as may be necessary.

Examples.

Multiply	s.	d.			Multiply	s.	d.		
	3	7½	by 19			1	11½	by 75	
		6					12		
	1	1	10½	= 6 times		1	3	9	= 12 times
		3					6		
	3	5	7½	= 18 times		7	2	6	= 72 times
		3	7⅛	= 1 time			5	11¼	= 3 times
	£3	9	3¼	= 19 times		£7	8	5¼	= 75 times

What cost—

Yds.	s.	d.		£.	s.	d.	lbs.	£.	s.	d.		£.	s.	d.
17 at	5	6½	—*A.*	4	14	2½	29 at	3	6	3¼	—*A.*	96	1	10¼
23 at	2	8	—*A.*	3	1	4	34 at	0	17	6	—*A.*	29	15	0
39 at	13	6¾	—*A.*	26	8	11¼	150 at	0	6	5¼	—*A.*	48	5	7½

RULE.—When the number is between 156 and 1000, find the product of the money by 100, and observe the work of the following example:

Examples.

	s.	d.	
Multiply	17	6½	by 454
		10	
	8	15 5	= 10 times
		10	
	87	14 2	= 100 times
		4	
	350	16 8	= 400 times
	43	17 1	= 50 times or 5 times 10 times
	3	10 2	= 4 times the upper line
	£398	3 11	= 454 times

What cost—

cwts.	£.	s.	d.		£.	s.	d.	cwts.	£.	s.	d.		£.	s.	d.
191 at	8	9	7	—*A.*	1619	10	5	898 at	0	18	7¾	—*A.*	837	3	11½
578 at	0	14	9¾	—*A.*	423	1	7½	753 at	1	12	9	—*A.*	1283	0	9

BILLS.

Bought of William Bean.

19 Yards of Silk ..... at 14s. 6d. per Yard.
12 do. of do. ..... at 15s. 8d. do.
14 do. of Satin ..... at 7s. 6d. do.
10½ do. of do. ..... at 6s. 8d. do.
11 Scarves ..... at 22s. 1d. each.

Sum £44 1 5

Bought of Robert Gleadow.

18lbs. of Raisins	..... at	0s.	9½d. per lb.
110lbs. of Currants	..... at	0s.	6½d. do.
74lbs. of Sugar	..... at	0s.	7½d. do.
75lbs. of Malaga Raisins	at	0s.	10½d. do.
3 Sugar Loaves, wt. 125¼lbs	at	0s.	9d. do.

Sum £13 19 5¼

Bought of John Hall.

Oats	16½ Bushels	... at	2s. 4d.	per Bus.
Malt	8½ Quarters	... at	26s. 0d.	per Qr.
Peas	16 Bushels	... at	3s. 7½d.	per Bus.
Tares	17 do.	at	1s. 11d.	do.
Beans	119 do.	at	4s. 6d.	do.

Sum £44 5 0

DIVISION OF MONEY.

RULE.—Begin with the left hand denomination and divide it; and when Pounds remain turn them into Shillings, taking in Shillings; then ask how often the Divisor can be had in the Shillings, and set down the Quotient; and, if Shillings remain, turn them into Pence, taking in any odd Pence; ask how often the Divisor can be had in the Pence, set down the Quotient, and if Pence remain turn them into Farthings and take in any odd Farthings; then having asked how often the Divisor can be had in them set down the Quotient, and when there is a remainder write it over a line. Proof.—Multiply the Quotient by the Divisor.

Examples.

£. s. d.	£. s. d.	£. s. d.	£. s. d.
2)7 15 7¼	3) 4 12 6¼	4) 5 3 2	5)4 13 8¼
£. s. d.	£. s. d.	£. s. d.	£. s. d.
6)9 16 5½	7)10 10 2¼	8)16 14 11½	9)5 13 5¼

Divide £127 by 10, the same by 11, and again by 12.

Note.—To find the $\frac{1}{2}$ (half), $\frac{1}{4}$ (quarter), $\frac{1}{5}$ (one fifth), or $\frac{1}{6}$ (a sixth) part, divide by 2 for $\frac{1}{2}$, by 4 for $\frac{1}{4}$, by 5 for $\frac{1}{5}$, by 6 for $\frac{1}{6}$.

Find the $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{5}$, and $\frac{1}{6}$th part of £4 15s.

When the Divisor is more than 12, observe the work of these examples, and note, in particular, where the odd s. d. and f. are taken in.

£. s. d.
15)36 14 4½
30
6
20 Add 14s.
15)134(8 Proof
120
14
12 Add 4d.
15) 172(11
15
22
15
7
4 Add 2 f.
15) 30(2
30

£. s. d.
(2 8 11½
5
12 4 9½ = 5 times
3
36 14 4½ = 15 times

£. s. d.
78) 8 17 6½
20 Add 17s.
78) 177(2
156
21
12 Add 6d.
78) 258(3
234
24
4 Add 2 f.
78) 98(1
78
Remainder 20 Farthings.

£. s. d.
(0 2 3½
12
1 7 3 = 12 times
6
8 3 6 = 72 times
13 7½ = 6 times
5 Remainder
Proof 8 17 6½

Divide £274 15s. 6½d. by 27.
Divide £5000 among 375 men equally.
If 473 yards cost £44 6s. 10½d., what cost one?
Bought 907 oranges for £7 11s. 2d., what cost one?
At £16 14s. 10½d. for 342 lbs., what cost one?

TROY WEIGHT.

For Gold, Silver, and Jewels.

24 Grains (gs.) 1 Pennywt. (dwt.)
20 Pennyweights 1 Ounce. (oz.)
12 Ounces .... 1 Pound. (lb)

AVOIRDUPOISE WEIGHT.

For Bread, Groceries, and all coarse Articles.

16 Drams (dr.).. 1 Ounce. (oz.)
16 Ounces .... 1 Pound. (lb.)
28 Pounds .... 1 Quarter. (qr.)
4 Quarters.. 1 Hund. wt. (cwt.)
20 Hundred wt. 1 Ton. (tn.)

APOTHECARIES WEIGHT.

For Medicines.

20 Grains.... 1 Scruple. (℈)sc.
3 Scruples.. 1 Dram. (ʒ)dr.
8 Drams .. 1 Ounce. (℥)oz.
12 Ounces .. 1 Pound. (lb)

CLOTH MEASURE.

2¼ Inches .. 1 Nail. (nl.)
4 Nails.....1 Quarter. (qr.)
4 Quarters . 1 Yard. (yd.)
5 Quarters 1 Ell English. (e.e.)

WINE MEASURE.

For all Liquors, except Ale & Beer.

2 Pints ..... 1 Quart. (qt.)
4 Quarts .... 1 Gallon. (gal.)
10 Gallons .... 1 Anker.
18 Gallons .... 1 Rundlet.
42 Gallons .... 1 Tierce.
63 Gallons..1 Hogshead. (hhd.)
84 Gallons .... 1 Puncheon.
2 Hogsheads .. 1 Pipe.
2 Pipes ..... 1 Tun.

ALE & BEER MEASURE.

2 Pints ..... 1 Quart. (qt.)
4 Quarts .... 1 Gallon. (gal.)
9 Gallons .... 1 Firkin. (f.)
2 Firkins .... 1 Kilderkin.
2 Kilderkins .. 1 Barrel. (brl.)
54 Gallons..1 Hogshead. (hhd.)
2 Hogsheads .. 1 Butt.

DRY MEASURE.

For all Dry Goods.

2 Pints ..... 1 Quart. (qt)
2 Quarts ..... 1 Pottle.
2 Pottles .... 1 Gallon. (gal.)
2 Galls. or 8 Quarts 1 Peck. (pk)
4 Pecks..... 1 Bushel. (bus.)
8 Bushels ..... 1 Chaldron.
36 Bushels 1 Chaldron of Coals.

N.B. Some other articles 32 Bushels are a Chaldron.

LONG MEASURE.

3 Barleycorns 1 Inch. (in.)
4 Inches .... 1 Hand.
12 Inches .... 1 Foot. (ft.)
3 Feet..... 1 Yard. (yd.)
6 Feet..... 1 Fathom.
5½ Yards .... 1 Rod or Pole.
40 Poles .... 1 Furlong. (fur)
8 Furlongs .. 1 Mile. (m.)
3 Miles .... 1 League.
69½ Miles .... 1 Degree.

LAND OR SQUARE MEASURE.

144 Square Inches 1 Sq. Foot. (ft.
9 Square Feet.... 1 Sq. Yard. (yd.
30¼ Square Yards 1 Sq. Per. (per.
40 Square Perches 1 Sq Rood. (roo
4 Square Roods. 1 Sq. Acre.
640 Square Acres . 1 Sq. Mile.

SOLID OR CUBIC MEASURE.

1728 Cubic Inches 1 Cubic Foot. (ft
27 Cubic Feet . 1 Cubic Yard. (yd
274¼ Cubic In. 1 Gallon of Wine.

TIME.

60 Seconds..... 1 Minute.
60 Minutes ..... 1 Hour.
24 Hours ..... 1 Day.
7 Days ..... 1 Week.
4 Weeks ..... 1 Month.
12 Calendar Months, or 365 Days and 6 Hours, 1 Year.

Thirty days has September,
April, June, and November;
February has twenty-eight alone,
All the rest have thirty-one;
But in Leap-year, once in four,
February has one day more,—
Except in 1700, 1800, 1900, &c.

REDUCTION.

Reduction is the bringing of numbers of one denomination, into numbers of another denomination, retaining the same value.

RULE 1.—To reduce to a less denomination, multiply by as many of the next less as make one of the greater; for instance, to reduce pounds to farthings, bring the pounds into shillings, the shillings into pence, and the pence into farthings, and when there are any shillings, pence, and farthings with the pounds add them to their respective denominations. Prove the following examples by Division :—

Examples.

Reduce £27 into farthings.

£.	
27	
20	
540	shillings.
12	
6480	pence.
4	
4)25920	farthings.
12) 6480	
2,0) 54,0	
£27	Proof.

Reduce £5 17s. 6¼d. into fars.

£.	s.	d.	
5	17	6¼	
Add 17s.	20		
	117		shillings.
Add 6d.	12		
	1410		pence.
Add ¼	4		
	4)5641		farthings.
	12)1410¼		
	2,0) 11,7	6¼	
£5	17	6¼	Proof.

In £9 how many shillings, pence, and farthings? *A.* 180s. 2160d. and 8640f.

In £7 14s. 6¼d. how many farthings? *A.* 7417f.

Reduce £46 14s. 9¾d. into farthings. *A.* 44871f.

Reduce £50 9s. 9½d. into half-pence. *A.* 24235.

What number of half-pence in £3124 19s? *A.* 1499976.

In 900 guineas how many sixpences and pence? *A.* 37800 sixpences, 226800d.

Reduce £160 15s. 6d. into sixpences. *A.* 6431.

RULE 2.—To bring a less denomination to a greater; divide by as many of the less as make one of the next greater. Thus, to bring farthings into pounds, first divide by 4, for pence; divide the pence by 12 for shillings; lastly divide the shillings by 20 for pounds. Prove the examples to this rule by Multiplication.

Examples.

In 8640 farthings how many pence, shillings, and pounds? *A.* 2160d., 180s., £9.

In 7417 farthings how many pounds? *A.* £7 14s. 6¼d.

Reduce 44871 farthings into pounds. *A.* £46 14s. 9¾d.

Reduce 24325 half-pence into pounds. *A.* £50 9s. 9½d.

Reduce 6431 sixpences into pounds. *A.* £160 15s. 6d.

Reduce 10905 twopences into pounds. *A.* £90 17s. 6d.

In 720d. how many shillings and crowns? *A.* 60s. 12cr.

Reduce 12600d. into groats, shillings, and crowns. *A.* 3150 gr. 1050s. 210 cr.

Reduce 5160 groats into shillings, crowns, and pounds. *A.* 1720s. 344cr. £86.

How many shillings and guineas are in 4284d.? *A.* 357s. 17 guineas.

How many crowns and pounds are in 11 20 sixpences? *A.* 112 cr. £28.

For both Rules.

In 720 shillings how many pence and crowns? *A.* 8640d. 144 cr.

In 612 half-crowns how many crowns and pence? *A.* 306 crowns, 18360d.

In 40 guineas how many shillings, crowns, and pounds? *A.* 840s. 168 cr. £42.

Reduce 12600 pence into shillings, groats, and crowns. *A.* 1050s. 3150 grs. 210 cr.

How many crowns, groats, and pounds in 1720 shillings? *A.* 344 cr. 5 160 gro. £86.

Change 755 crowns into guineas, and then sovereigns. *A.* 179 gui. 16s. 188 sov. 15s.

In 500 guineas, as many sovereigns, and as many shillings, how many half-crowns? *A.* 8400.

TROY WEIGHT.

Reduce 4 lbs. 5 oz. 16 dwts. 17 grs. to grains.

Add 5oz. 12

53 oz.

Add 16d. 20

1076 dwts.
24

4304
2152 Add 17 grs.

25841 grs.

Proof 2,0
24)25841 (107,6 dwts. 17grs.
24

12) 53 16 17 .

184
168

4lb.5oz.16dwt.17gs.

166
144

17

In 47 lb. 10 oz. how many grains? *A.* 275520 grs.

In 47128 grains of gold how many lbs.? *A.* 8 lbs. 2 oz. 3 dwts. 16 grs.

AVOIRDUPOISE WEIGHT.

In 6 Tons. 12 cwt. 3 qrs. 15 lbs. how many lbs?

6 tons. 12 cwts. 3 qrs. 15 lbs.
20 Add 12

132 cwts.
4 Add 3

531 qrs.
28

4248
1062 Add 15

14883 lbs.

Proof 4
28)14883 (531 qrs. 15 lbs.
140

2,0)13,2 cwt. 3 qrs. 15 lbs.
88
84

6 t. 12 cwt. 3qrs. 15lbs

43
28

15 lbs.

In 7 cwt. 3 qrs. 10 lb. how many ounces and drams? *A.* 14048 oz., 224768 drs.

In 6720 lb. of iron how many tons? *A.* 3 tons.

APOTHECARIES WEIGHT.

In 12 lb. 1 ℥. 2 ʒ. 0 ℈. 1 gr. how many grains? *A.* 69721 grains.

In 16972 grs. how many lbs? *A.* 2lb.11oz.2dr.2sc.12gs.

LONG MEASURE.

In 70 miles how many furlongs and poles? *A.* 560 fur. 22400 poles.

In 4000 inches how many yards? A. 111 yds. 4 in.

How many barley-corns will reach 10 miles? *A.* 1900800 b. c.

CLOTH MEASURE.

In 14 yards how many quarters and nails? *A.* 56 qrs. 214 nails.

In 4712 nails how many yards? *A.* 294 yds. 2 qrs.

In 7000 nails how many English ells? *A.* 350 ells.

LAND MEASURE.

In 40 acres how many roods and perches? *A.* 160 rds. 6400 perches.

Reduce 2850 perches to acres. *A.* 17 ac. 3 rs. 10 ps.

WINE MEASURE.

In 174 gals. how many quarts and pints? *A.* 696 qts. 1392 pints.

In 2764 gallons how many hogsheads and puncheons? *A.* 43 hhds. 55 gals. 32 punchs. 76 gals.

ALE AND BEER MEASURE.

In 6542 firkins how many pints? *A.* 471024 pints.

Bring 7 brls. 1 kild. 1 fir. into gals? *A.* 279 gals.

DRY MEASURE.

In 40 quarters of wheat how many bushels and pecks? *A.* 320 bus. 1280 pecks.

Reduce 7094 pecks into chalds.? *A.* 49 ch. 9 b. 2 ps.

TIME.

In 121812 sec. how many hours? *A.* 33h. 50m. 12sec.

Reduce 41 weeks into days, hours, and minutes. *A.* 287 days, 6888 hours, 413280 minutes.

ADDITION OF WEIGHTS & MEASURES.

RULE.—Write over each denomination as many of it as make one of the next left hand; by this number divide the sum of the column; set down the remainder, and proceed as in the annexed work. Prove the example, as in Addition of Integers.

TROY WEIGHT.

	12	20		20	24
lb.	*oz.*	*dwt.*	*oz.*	*dwt.*	*gr.*
8	7	8	13	9	7
7	10	9	24	15	12
15	0	6	27	18	9
7	2	9	16	16	4
38	11	14	42	12	15
77	8	6	125	11	23

dwt. oz.
20) 46 (2 carried to the oz.
40
Rem. 6 *oz* 12)32(2 carried to the lbs.
24
Rem. 8

grs. dwt.
24) 47 (1 carried to the dwts.
24 *dwt. oz.*
20)71 (3 carried to the oz
Rem. 23 60
Rem. 11

AVOIRDUPOISE WEIGHT.

cwt.	*qr.*	*lb.*	*lb.*	*oz.*	*dr.*
4	1	6	4	7	10
8	0	7	21	0	4
4	0	4	4	5	0
17	1	16	30	0	7
51	3	4	17	11	0

APOTHECARIES WEIGHT.

lb.	*oz.*	*dr.*	*dr.*	*sc.*	*gr.*
3	7	7	7	2	4
29	2	1	1	0	11
4	10	3	1	0	11
90	11	3	0	2	18
25	9	8	2	0	14

CLOTH MEASURE.

yd.	*qr.*	*na.*	*c. e.*	*qr.*	*na.*
17	2	0	4	2	2
0	3	0	9	3	0
1	2	0	0	2	0
24	0	3	26	3	0
18	2	3	45	2	2

DRY MEASURE.

ch.	*bu.*	*pec.*	*qrs.*	*bu.*	*pec.*
12	12	2	4	0	2
0	11	6	13	2	0
3	14	2	5	1	1
28	13	3	0	7	1
17	24	0	40	3	0

LONG MEASURE.

mi.	fur.	po.
26	0	1
7	1	0
1	2	6
4	6	9
38	6	10

yd.	ft.	in.
7	2	10
0	1	6
29	0	9
12	2	8
8	1	0

SQUARE MEASURE.

ac.	roo.	per.
35	0	22
7	0	15
0	3	39
90	2	6
24	3	18

yd.	ft.	in.
3	7	10
39	6	39
9	8	8
3	5	98
87	7	75

CUBIC MEASURE.

yd.	ft.	in.
1	18	6
4	6	9
28	2	80
90	5	3
8	3	66

yd.	ft.	in.
9	0	62
3	6	781
16	3	800
94	5	649
10	8	98

WINE MEASURE.

tun.	hhd.	gal.
17	2	9
8	3	60
0	2	9
34	1	46
19	3	8

hhd.	gal.	qt.
94	18	0
3	26	3
18	54	1
1	36	0
42	5	3

ALE AND BEER MEASURE.

b.	fir.	gal.
19	0	7
6	1	4
3	2	0
98	3	2
6	2	7

f.	gal.	qt.
8	2	0
0	6	0
39	2	0
4	0	1
36	5	0

TIME.

mo.	wk.	da.
18	3	0
4	2	5
80	0	6
0	3	3
24	2	6

ho.	min.	sec.
9	8	24
4	24	5
18	35	16
1	58	43
26	49	59

SUBTRACTION OF WEIGHTS & MEASURES.

RULE.—Write over each denomination its number, as in the last rule. When the number to be subtracted is greater than the upper, subtract it from the number written over it; and to the remainder add the upper number; set down the sum of the two, and carry one to the next left hand number, and thus continue the work.

TROY WEIGHT.

lb.	12 oz.	20 dwt.
14	9	14
10	0	6

20 oz.	24 dwt.	gr.
18	3	2
2	15	17

AVOIRDUPOISE WEIGHT.

cwt.	qr.	lb.
15	1	10
2	1	20

lb.	oz.	dr.
98	12	13
10	2	14

APOTHECARIES WEIGHT.

lb.	*oz.*	*dr.*
28	0	2
2	2	3

dr.	*sc.*	*gr.*
90	2	20
1	2	11

CLOTH MEASURE.

yd.	*qr.*	*na.*
10	2	0
3	3	1

nls.	*qr.*	*na.*
46	0	3
6	1	2

DRY MEASURE.

ch.	*bu.*	*pec.*
24	3	1
4	4	2

qrs.	*bu.*	*pec.*
10	6	1
0	0	2

LONG MEASURE.

mi.	*fur.*	*po.*
58	4	21
1	6	3

yd.	*ft.*	*in.*
19	0	3
0	2	4

SQUARE MEASURE.

ac.	*roo.*	*per.*
12	2	10
1	2	30

yd.	*ft.*	*in.*
65	0	92
0	2	3

CUBIC MEASURE.

yd.	*ft.*	*in.*
18	2	110
3	20	13

yd.	*ft.*	*in.*
63	10	340
0	18	960

WINE MEASURE.

tun.	*hhd.*	*gal.*
27	2	50
17	3	14

hhd.	*gal.*	*qt.*
94	18	2
1	43	2

ALE AND BEER MEASURE.

b.	*fir.*	*gal.*
30	0	2
20	0	5

f.	*gal.*	*qt.*
10	3	3
9	5	0

TIME.

mo.	*wk.*	*da.*
44	3	4
35	0	5

ho.	*min.*	*sec.*
18	45	10
9	13	13

TIME.

wk.	*da.*	*ho.*
20	1	15
10	2	55

ho.	*min.*	*sec.*
10	30	28
1	45	35

MULTIPLICATION OF WEIGHTS & MEASURES.

RULE.—Write over each denomination its number for a divisor as in the last rule. Multiply the right hand denomination and divide the product by the divisor; set down the remainder and carry the quotient to the next product; and thus continue the work from right to left.

TROY WEIGHT.

	12	20
lb.	*oz.*	*dwt.*
73	9	18
		2

	20	24
oz.	*dwt.*	*gr.*
15	12	10
		3

AVOIRDUPOISE WEIGHT.

cwt.	*qr.*	*lb.*
9	2	12
		4

lb.	*oz.*	*dr.*
8	15	8
		5

APOTHECARIES WEIGHT.

lb.	*oz.*	*dr.*
11	8	7
		6

dr.	*sc.*	*gr.*
13	2	18
		7

CLOTH MEASURE.

yd.	*qr.*	*na.*
19	2	1
		8

ells.	*qr.*	*na.*
17	0	3
		9

DRY MEASURE.

ch.	*bu.*	*pec.*
25	4	3
		10

qrs.	*bu.*	*pec.*
26	2	1
		11

LONG MEASURE.

mi.	*fur.*	*po.*
28	3	15
		12

yd.	*ft.*	*in.*
29	0	4
		12

SQUARE MEASURE.

	ac.	*roo.*	*per.*	
Mult.	7	3	12	by 18

CUBIC MEASURE.

	yd.	*ft.*	*in.*	
Mult.	8	14	28	by 24

WINE MEASURE.

	tun.	*hhd.*	*gal.*	
Mult.	13	2	50	by 49

ALE AND BEER MEASURE.

	b.	*fir.*	*gal.*	
Mult.	19	2	5	by 120

TIME.

	mo.	*wk.*	*da.*	
Mult.	24	2	6	by 53

TIME.

	mo.	*wk.*	*da.*	
Mult.	14	2	6	by 74

DIVISION OF WEIGHTS & MEASURES.

RULE.—Write over each denomination its number as in the last rules. Begin with the left hand denomination and divide. Reduce what remains to the next denomination, taking in any odd weight, &c., thus go on dividing from left to right. Prove the work by Multiplication.

TROY WEIGHT.

lb.	*oz.*	*dwt.*
2)3	11	12

oz.	*dwt.*	*gr.*
3)7	12	19

AVOIRDUPOISE WEIGHT.

	4	20
cwt.	*qr.*	*lb.*
4)8	2	13

		16	16
lb.	*oz.*	*dr.*	
5)6	10	8	

APOTHECARIES WEIGHT.

lb.	*oz.*	*dr.*
9)9	9	3

dr.	*sc*	*gr.*
7)4	6	19

CLOTH MEASURE.

yd.	*qr.*	*na.*
8)57	3	0

ells.	*qr.*	*na.*
9)81	0	2

DRY MEASURE.

bu.	*pec.*	*gals.*		*chal.*	*bu.*	*pec.*
10)9	3	1		11)2	4	2

LONG MEASURE.

mi.	*fur.*	*po.*		*yd.*	*ft.*	*in.*
12)67	7	34		12)19	2	11

LAND MEASURE.

	ac.	*roo.*	*per.*		
Divide	7	2	20	by	28

CUBIC MEASURE.

	yd.	*ft.*	*in.*		
Divide	17	15	28	by	64

WINE MEASURE.

	hhd.	*gal.*	*qt.*		
Divide	126	19	2	by	172

ALE AND BEER MEASURE.

	f.	*gal.*	*qt.*		
Divide	16	7	2	by	49

TIME.

	ho.	*min.*	*sec.*		
Divide	19	26	39	by	45

TIME.

	mon.	*wk.*	*da.*		
Divide	89	1	4	by	27

Examples for exercises on the preceding rules.

ALL TO BE PROVED.

Add together, seven hundred and nine; four hundred thousand and sixty; and nine hundred and twenty-five.

Subtract 197 from the sum of 4764 and 37; and add ten thousand and forty to the remainder.

What is the difference between 1573 and the product of 27, and 1276?

Divide the product of 3765 and 36, by 45.

What is the quotient of 784539 by 2691?

A man was born in 1801, when will he be 98 years old?

King George 4th. died in 1830 aged 68, in what year was he born?

Multiply £3 17s. 3¼d. by 54, and subtract £12 13s. 6¾d. from the product.

Divide £375 by 24 and multiply the quotient by 104.

How many farthings are there in £27 14s. 1½d?

Reduce £127 13s. 6d. to half-pence.

In 4lb. 3oz. 4dwts. troy, how many grains?

How many ounces in 7cwt. 1qr. 27lb.?

Reduce 17yds. 3qrs. into ells English.

In 21 hogsheads of wine how many casks, each 6 gallons?

In 12 ingots of silver, each 21oz. 14dwts., how many grains? *A.* 124992.

In 25 chests of tea, each 2qrs. 11lbs., how many lbs.?

How many days in the first six calendar months of the year 1835?

How many hours and minutes in a year?

How many days from January 20 to July 4, in a leap year?

My income is £400 a year, what is it a day?

THE RULE OF THREE DIRECT.

The Rule of Three Direct teaches from three numbers or terms given, to find a fourth; which is to have the same proportion to the third, that the second has to the first. Thus 3 , 6 , 4 , 8 are numbers, of which the fourth has the same proportion to the third, that the second has to the first; the 8 being double the 4; and the 6 double the 3; and they may be read thus, as 3 is to 6 so is 4 to 8.

RULE.—To find the fourth term, place the three numbers as below, with points; then multiply the second by the third, or the third by the second, and divide the product by the first; the quotient will be fourth term.

What is the fourth term to 2, 8, and 7?

2 : 8 :: 7

8

2)56

28

Find the fourth proportional to 9, 6, and 24.

What is the fourth proportional to 36, 9, and 1728?

RULE 2.—When the three terms are of different denominations, place the two terms of supposition, so that the second be of the same kind as the required term; and let the third be the same as that on which the question lies. Then multiply and divide as before directed, and the quotient will be the answer. Proof.—Make a stating by inverting the order of the terms, as in the next example.

OBSERVE.—*Two of the three given terms are always a supposition.*

Examples.

If 4 yards cost 8 shillings, what cost 7 yards ?

If 4 yds. : 8s. :: 7 yds.

7

4)56

Ans. 14 shillings.

Proof.

If 14s. : 7 yds. :: 8s.

8

14)56(4 yds.

56

If 3lbs. cost £19, what cost 9lbs. ? *A.* £57.

If £19 buy 3lbs., how much will £57 buy ? *A.* 9lbs.

If 52 weeks' wages be £48, what will 13 weeks be ? *A.* £12.

If 3oz. of silver cost 16s. 7½d., what cost 11oz. ?

If 3 oz. : 16s. 7½d. :: 11oz.

11

3)9 2 10½

Ans. £3 0s. 11½d.

What will 9 yards cost, if for £44 I buy 72 yards ? *A.* £5 10s.

If 21 yards cost £7 17s. 6d., what cost 35 yards ? *A.* £13 2s. 6d.

What cost 120 quills, if 24 cost 3½d. ? *A.* 1s. 5½d.

If 120 quills cost 1s. 5½d., what cost 24 ?

If £57 buy 3cwt. 1qr. 5lbs. of tea, how much will £19 buy ? *A.* 1cwt. 0qrs. 11lbs.

If for £19, I buy 1cwt. 0qrs. 11lbs., what can I buy for £152 ? *A.* 8cwt. 3qrs. 4lbs.

RULE 3.—If the first and third terms are of different denominations, reduce them into the same; and, if necessary, reduce the second term to the lowest denomination mentioned; then multiply and divide, and the quotient will be of the same name as the second term, and may require reduction.

Examples.

If 3cwt. 2qrs. of tobacco cost £29 8s., what are 7lbs. of it worth? *A.* 10s. 6d.

How many yards of muslin may be bought for £44 16s., if 9yds. cost £5 12s.? *A.* 72 yards.

How many yards of cloth may be bought for £5 12s., if 72yds. cost £44 16s.? *A.*

If 5cwt. 2qrs. cost £25, what cost 27cwt. 2qrs.? *A.* £125.

If 15gals. 3qts. of ale cost £1 3s. 7½d., what cost 2gals. 1qt.? *A.* 3s. 4½d.

If in 3hrs. 15 min. a bird flies over 80 miles, how far will it fly in 19hrs. 30 min.? *A.* 480 miles.

If 5ells 3qrs. cost £4 13s. 4d., what cost 52yds. 1 qr?

ells.	*qrs.*		*£.*	*s.*	*d.*		*yds.*	*qr.*
If 5	3	:	4	13	4	::	52	1
5			20				4	
28 qrs.			93 shillings.				209 qrs.	
			12					
			1120 pence.					
			209					
			10080					
			2240					

	d.	PROOF.	*qrs.*		*d.*
If	8360	:	209	::	1120
			1120		
			4180		
			2299		

8360)234080(28 qrs.

28)234080(8360 pence to be reduced.

12

2,0) 69,6s. 8d.

Ans. £34 16 8d.

If 7cwt. 1qr. cost £26 10s. 4d., what cost 43cwt. 2 qrs.?

If 2cwt. 2qrs. 15lbs. be bought for £7 19s. 9½d., how much will £10 5s. 10d. buy?

If £10 2s. 7d. buy 17 yards, how much will £36 6s. 11d. buy? *A.* 61 yards.

If 5cwt. 3qrs. of sugar cost £25 17s. 6d., what cost 7cwt. 3qrs. 7lb.? *A.* £35 3s. 1½d.

If 5oz. 16dwts. of silver cost £2 10s. 9d., what cost 3lb. 7oz.? *A.* £18 16s. 3d.

If 24qrs. 6bus. of corn cost £42 12s. 6d., what cost 123qrs. 6bus.? *A.* £213 2s. 6d.

If a man walk 4miles 5f. in one hour and 50 minutes; how long will he be in walking 9mis. 2fur. at the same rate? *A.* 3 hours 40 minutes.

If 2 acres 2 roods produce 12qrs. 6bus. of corn; how much will 3 acres, 2 roods, 20 perches of the same land produce? *A.* 18qrs. 3bus. $3\frac{7}{40}$ pecks.

If 4hhds. 21gals. of wine cost £125 10s. 6d., what cost 21hhds. 42gals? *A.* 627 12s. 6d.

If £145 rent pays £12 13s. 9d. taxes, what is the tax on £378 10s.? *A.* £33 2s. 4½d.

If £100 gain £5 interest, what is the interest on £475 10s? *A.* £23 15s. 6d.

What is the tax on £900, if £1 pays 2s. 6d.? *A.* £112 5s.

A bankrupt owes £9000 10s., how much can he pay at 15s. 6d. per pound? *A.* £6975 7s. 9d.

A bankrupt pays £6975 7s. 9d. at the rate of 15s. 6d. a pound, what was he in debt?

What is the carriage of 8cwt. 3qrs. 7lb. at 20d. a stone of 14lbs.? *A.* £5 17s. 6d.

If £21 13s. 5½d. be interest for 365 days, what is it for 150 days? *A.* £8 18s. 1½d.

What cost 49392 knives at 4s. 4d. per dozen? *A.* £891 16s.

At 6s. 8d. a week, how many weeks board can I have for £50? *A.* 150 weeks.

If £10 gain eight shillings and four-pence, what will £500 10s. gain? *A.* £20 17s. 1d.

THE RULE OF THREE INVERSE.

In examples to this rule, the term on which the demand lies, has the same proportion to one of the terms of the supposition, as the other term of the supposition, has to the term required.

RULE.—For a stating, place the term on which the demand lies, first; and the two terms of supposition

second and third, with points; as in the Rule of Three Direct. Then reduce the terms, if necessary, and work as directed in that rule.

Examples.

If I borrow of my friend £500 for 6 months, I demand to know, how long I ought to lend to him £75 to requite his kindness?

£.		£.		mo.		£.		mo.		£.
If 75	:	500	::	6	Or 75	:	6	::	500	
		6					500			
		75)3000(40 mo.					75)3000(40 mo.			
		300								
		... 0					Ans. 40 months.			

Suppose 36 men can build a boat in 12 days, in how many, can 27 build it? *A.* 16 days.

How far can I have 4tons 2cwt. carried for the same money that I pay for 15 tons, carried 20 miles? *A.*

How many yards of stuff, 3qrs. wide, will line 30 yards of cloth 5qrs. wide? *A.* 50 yards.

If 30 men earn £25 in 25 days, how long will 15 men be in earning the same wages? *A.*

What should a loaf weigh, when wheat is 3s. a bushel; if when at 5s. 3d. it weighs 2lbs. 8oz.? *A.* 4lbs. 6oz.

If a loaf weighs 4lb. 6oz. when wheat is 4s. 6d. a bushel, what should it weigh when wheat is 5s. 3d. a bushel? *A.* 3lbs. 12oz.

How many yards of carpet 3qrs. wide, will cover a floor 18 feet long and 15 feet wide? *A.* 40 yards.

Suppose £400 to gain £50 in 10 months, in what time will £250 gain the same money? *A.* 16 months.

FELLOWSHIP.

Fellowship is a rule used to calculate shares of gain and loss.

Rule.—Add the given shares together, make as many statings as there are shares; saying—

As the sum of the shares, or stocks : is to the whole gain or loss, :: so is each share, or stock, : to its share of gain or loss.

Proof.—Add all the shares of gain or loss together, and the sum will be equal to the given gain or loss; or invert the terms of the statings.

Examples.

Divide £140 among A. B. and C., so that A. shall have one share, B. two, and C. three.

A	1	As 6	:	140	::	1				£.	*s.*	*d.*
B	2			1					A	23	6	8
C	3							Ans.	B	46	13	4
	—			6)140					C	70	0	0
Sum	6											
	—			23	6	8		Proof		140	0	0

As 6	:	140	::	2		As 6	:	140	::	3
		2						3		
		6)280						7)420		
		46	13	4				69		

A's stock is £70, B's £35, they gain £150, what is each man's share of gain? *A.* A £100, B £50.

B puts in £300, C £75, and D £150; they gain £260, what is each share of gain? *A.* B £150, C £37 10s., D £75.

E, F, and G lose in partnership £120; E put in £140, F £300, and G £160, how much did each lose? *A.* E £28, F £60, C £32.

H, J, and K are joint ship owners; H gains £28, J £60, and K £32, the ship cost £600, what did each part cost?

Messieurs L, M, N, and O, engage in trade and lose £1000; L's stock is £400, M's £500, N's £900, and O's £1200, what is each merchant's loss? *A.* L £133 6s. 8d., M £166 13s. 4d., N £300, and O £400.

FELLOWSHIP WITH TIME.

RULE.—Multiply each sum by its time, and add the products together; then state and say,—

As the sum of the products : is to the whole gain or loss, :: so is each product : to its share of gain or loss.

Examples.

X puts £10 for 5 months, Y £8 for 10 months, and Z £6 for 5 months; they gain £60, what is each share?

£.	£.	£.	£.
10	8	6	X 50
5	10	5	Y 80
—	—	—	Z 30
X 50	Y 80	Z 30	—
			Sum 160

	£.		£.		£.		£.	s.
As	160	:	60	::	50	:	18	15

50

16,0)300,0

£18 15s.

	£.		£.		£.		£.	s.
As	160	:	60	::	80	:	30	
As	160	:	60	::	30	:	11	5

		£.	s.		£.		£.	s.
Ans.	X	18	15	Y	30,	Z	11	5
	Y	30	0					
	Z	11	5					

Proof £60 0s.

The rent of a pasture is £30 10s. A puts in 12 sheep for 3½ months; B puts in 8 for 8½ months, and C 10 for 5 months; how much must each pay of the rent? *A.* A £8 0s. 1½d., B £12 19s. 3d., and C £9 10s. 7½d.

E, F, and G lost £100 in partnership; E had £50 for 2 months, F £50 during 4 months, and G £60 for 5 months; what is each merchant's share of the loss? *A.* E's £16 13s. 4d., F's £33 6s. 8d., and G's £50.

BARTER.

Barter is the exchange of one commodity for another.

RULE.—Find the value of each commodity, and work by the Rule of Three, or otherwise, as the case may require.

Examples.

B delivers to C 49 yards at 3s. 4d. a yard, for 38 ells at 4s. 2d. an ell, what is the difference of value, and who must pay it? *A.* The difference is 5s. which C must pay.

How much tea at 10s. per lb. can I have in barter for 1cwt. 2qrs. 10lb. of chocolate, at 5s. per lb.? *A.* 89lbs.

A had 41cwt. of hops at £1 10s. per cwt., for which B gave £20 in money and the rest in prunes at 5d. per lb.; what weight of prunes did B give besides the £20? *A.* 17cwt. 3qr. 4lb.

X delivered to Y 189 gallons of wine at 6s. 8d. per gallon, for 126 yards of silk, what was the silk a yard? *A.* 10s.

LOSS AND GAIN.

RULE 1.—Find the difference between the whole cost and the whole produce.

Examples.

Bought 18cwt. of sugar at 28s. per cwt. which I sell at 3½d. per lb., what is the gain? *A.* £4 4s.

Bought butter at 20d. per lb. and sold at 17d., what is the loss on 1440lb.? *A.* £18.

Bought 137lb. of tea at 4s. 1½d. per lb. and sold at 4s. 9d., what was the gain?

RULE 2.—As the first cost : is to the price sold at : : so is £100 : to a fourth number.

If the 2nd. term be more than the first, subtract £100 from the fourth number, and the remainder will be the gain per cent. or on £100.

If the 2nd. term be less than the first, subtract the fourth number from £100, and the remainder will be the loss per cent.

Examples.

Bought wine for £50 8s. and sold for £63, what is the gain per cent.? *A.* £25.

Tea, which cost me 12s. per lb. I sold at 16s. per lb., what was the gain per cent.? *A.* £33 6s. 8d.

Sold for £1460, a ship which cost £1800, what was the loss per cent? *A.*

ALLIGATION.

Alligation teaches how to mix quantities of different simples together, and to find the mean price of the mixture.

ALLIGATION MEDIAL

Is when the quantities and prices are given.

Rule.—Multiply each quantity by its rate or price, divide the sum of the products by the sum of the quantities, and the quotient will be the mean price. Proof by Division.

Examples.

A farmer mixed 20 bushels of wheat, at 5s. per bushel, with 40 bushels of rye at 3s., what is the price of a bushel of this mixture?

Observe × *signifies multiplied by; and* = *equal to.*

$$20 \times 5 = 100 \text{ shillings.}$$
$$40 \times 3 = 120$$

Sum of the quantities 60 — 6,0)22,0 Sum of the Products

3s. 8d. Answer.

A grocer mixed 4cwt. of an article at 56s. per cwt. with 7cwt. at 43s. and 5cwt. at 37s.; what is the price of 1cwt. of the mixture? *A.* £2 4s. 4½d.

Ten gallons of brandy at 18s. 6d. were mixed with 4gals. at 15s. and two gallons of water; what is the price of a gallon? *A.* 15s. 3¾d.

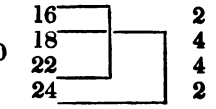
Mixed one gallon of rum at 16s. with one at 15s., and another at 14s. with one gallon of water; what is the price of one gallon of the mixture? *A.* 11s. 3d.

ALLIGATION ALTERNATE

Is when the prices of several things are given, to find

what quantities of each of them, will make a mixture that may have a given price.

RULE.—Place the rates one under the other, and the rate given or mean rate at the left hand of them, thus—

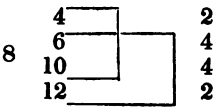


Link the several rates together by 2 and 2, always observing to join a greater to a less than the mean. Take the differences between each price and the mean rate, set them alternately, they will be the answer required. Proof.—By Alligation Medial.

Examples.

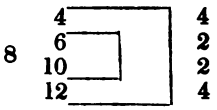
If I would mix sugar at 4d., 6d., 10d., and 12d. per pound, what quantity must I take of each, that a pound of the mixture may be worth 8d. ?

Work.



12

Or,



12

Answer.

	2lb. at 4d.	=	8d.
	4lb. at 24d.	=	24d.
	4lb. at 10d.	=	40d.
	2lb. at 12d.	=	24d.
Sum	12		12)96d.
		Proof	8d.

Another Answer.

	4lb. at 4d.	=	16d.
	2lb. at 4d.	=	12d.
	2lb. at 10d.	=	20d.
	4lb. at 12d.	=	48d.
	12		12)96d.
		Proof	8d.

How much rye at 4s. per bushel, barley at 3s., and oats at 2s., will make a mixture worth 2s. 6d. per bushel? *A.* 6bus. of rye, 6 of barley, and 24 of oats.

I would mix four sorts of rye, one sort at 4s. per bush. another at 3s. 6d., a third at 3s., and a fourth at 2s.; how much must I take of each sort to make the whole worth 2s. 6d. per bushel? *A.* 6bush. at 4s., 6 at 3s. 6d., 6 at 3s., and 36 at 2s.

ALLIGATION PARTIAL

Is when the rates of all the things, the quantity of but one of them, and the mean rate are given.

RULE.—Take the differences between each price and the mean rate, and place them as in the last rule. Then say—

As the difference of the same name with the quantity given : is to the rest of the differences severally, :: so is the quantity given : to each of the several quantities required.

Examples.

I want to mix 10 bushels of wheat at 4s. per bushel, with rye at 3s., barley at 2s., and oats at 1s.; how much rye, barley, and oats must be mixed with the 10 bushels of wheat, that the mixture may be worth 28d. per bushel?

28	48		4	4	:	16	::	10	:	40
	36		16	4	:	20	::	10	:	50
	24		20	4	:	8	::	10	:	20
	12		8							

					d.
	10	Bushels	at 48d.	are	480
Answer.	40	do.	at 36d.	...	1440
	50	do.	at 24d.	...	1200
	20	do.	at 12d.	...	240
	120			12,0)	336,0

Proof 28 pence.

I want to mix 12 bushels of oats at 18d. with barley at 2s. 6d., rye at 3s., and wheat at 4s. per bushel; how many of each sort must be mixed with the 12 bushels of oats?

	bus.			*bus.*	
1st. Ans.	60	of Barley,	*2nd. Ans.*	2	of Barley,
	60	of Rye,		12	of Rye,
	12	of Wheat.		10	of Wheat.

ALLIGATION TOTAL

Is when the price of each article, the quantity of the mixture, and the mean price are given, to find how much of each article will make the quantity.

RULE.—Take the differences between each price and the mean price, as before, then say—

As the sum of the differences : is to each difference, :: so is the quantity given : to the quantity required of each.

Examples.

I have tea at 5s., 6s., 8s., and 9s. per lb., and I want a mixture of 87lb. worth 7s. per lb.; how much of each must I take?

	5		1		6	:	1	::	87	:	$14\frac{1}{6}$
7	6	*Differences.*	2		6	:	2	::	87	:	29
	8		2		6	:	2	::	87	:	29
	9		1		6	:	1	::	87	:	$14\frac{1}{6}$
			6								87

Ans. $14\frac{1}{2}$lb. at 5s., 29lb. at 6s., 29lb. at 8s., and $14\frac{1}{2}$lb. at 9s.

A has currants at 11d., 9d., 6d., and 4d. per lb., and he wants a composition of 240lbs. worth 8d. per lb.; how much of each must he take? *A.* 96lb. at 11d., 48lb. at 9d., 24lb. at 6d., and 72lb. at 4d.

PRACTICE.

The rules of Practice are short methods of finding the value of any quantity of goods.

RULE 1.—If the number of pounds, yards, &c., be above 12, and the product of two factors in the multiplication table, multiply as directed in page 10.

OBSERVE.—*For $\frac{1}{4}$ divide the value of* 1 *ell, &c. by* 4, *for $\frac{1}{2}$, divide by* 2, *and for $\frac{3}{4}$ find the values of $\frac{1}{2}$ and $\frac{1}{4}$, and add them to the last product.*

What is the value of—

	£.	s.	d.		£.	s.	d.
$21\frac{1}{4}$ ells at	0	7	8	*A.*	8	2	11
$56\frac{1}{4}$ do.	0	17	11	*A.*	50	12	$3\frac{1}{4}$
$77\frac{3}{4}$ do.	1	15	5	*A.*	137	13	$7\frac{1}{4}$

	£.	s.	d.		£.	s.	d.
$96\frac{3}{4}$ Tons at	2	15	6	*A.*	268	9	$7\frac{1}{2}$
$108\frac{1}{4}$ do.	1	16	8	*A.*	198	9	2
$144\frac{1}{2}$ do.	0	17	4	*A.*	125	4	8

RULE 2.—If the number of yards, &c. is not found in the multiplication table, find the nearest next less or

greater number; and, having multiplied by its factors, add to the product or subtract from it, as many times the value of the top line, as the difference may require.

What is the value of—

yds.	£.	s.	d.		£.	s.	d.	*lbs.*	£.	s.	d.		£.	s.	d.
26¼ at	0	11	4	*A.*	14	17	6	127 at	3	0	2	*A.*	382	1	2
39 at	0	17	9½	*A.*	34	13	10½	117¼ at	0	12	6	*A.*	73	5	7½
59 at	1	13	6¼	*A.*	98	17	8¾	87½ at	0	4	3	*A.*	18	12	11¼
76 at	3	14	9½	*A.*	284	4	2	149¾ at	0	5	6¼	*A.*	41	6	8¾

RULE 3.—When the number of cwts., &c. is above 156, and not more than 1000, find the value of 100; multiply this value by the number of hundreds; and, for the rest, observe the work of the following example:—See also page 11.

What is the value of 273 tons at 9s. 8¼d. per ton?

	s.	*d.*				
	9	8¼	=	value of	1	ton.
	10					
	4	16 10½	=	do.	10	do.
	10					
	48	8 9	=	do.	100	do.
	2					
	96	17 6	=	do.	200	do.
	33	18 1½	=	do.	70	do.
	1	9 0¾	=	do.	3	do.
£	132	4 8¼	=	do.	273	do.

What is the value of---

709¼ cwts. at 12s. 6d. *A.* £443 5s. 7½d.	726 ells at 13s. 10½d. *A.* £502 18s. 1½d.
218 yds. at 14s. 10d. *A.* £157 19s. 6d.	997½ tons at £1 15s. 4d. *A.* £1762 5s. 0d.

RULE 4.—To find the value of one yard, pound, &c., divide by the given number as directed in Division of money, pages 12 and 13.

Examples.

What cost 1 ? if---

	£.	s.	d.		£.	s.	d.		£.	s.	d.		£.	s.	d.
9lbs. cost	6	10	6	*A.*	0	14	6	23lbs. cost	92	6	8¾	*A.*	4	0	3¾
17lbs. cost	56	19	4¼	*A.*	3	7	0¼	43lbs. cost	301	2	1¼	*A.*	7	0	0¾

RULE 5.—When the divisor is the product of two numbers, you may divide by one, and then by the other.

Examples.

What cost 1 ? if

yds.	£.	*s.*	*d.*	£.	*s.*	*d.*
96 cost ..	65	8	0	*A.* 0	13	7½
81 cost	116	8	9	*A.* 1	8	9
84 cost ..	75	12	0	*A.*		

yds.	£.	*s.*	*d.*	
90 cost	80	5	0	*A.*
110 cost	69	13	4	*A.*
144 cost	90	0	0	*A.*

Divide £2093 into 56 equal parts. Quot. £37 7s. 6d.

Divide £4592 10s. equally among 55 men. Q. £83 10s.

All these Examples should be proved by Multiplication.

Definition.—An aliquot part is the fractional expression of the quotient of a division, without a remainder. Thus 12)144(12 quotient; that is to say, 12 is one twelfth of 144, fractionally expressed by $\frac{1}{12}$.

TABLE OF ALIQUOT PARTS.

Aliquot parts of a £.				Parts of a shilling.			Parts of threepence.		
s.	*d.*			*d.*					
10	0	=	$\frac{1}{2}$	6	=	$\frac{1}{2}$	3 f.	=	$\frac{1}{4}$
6	8	=	$\frac{1}{3}$	4	=	$\frac{1}{3}$	2 f.	=	$\frac{1}{6}$
5	0	=	$\frac{1}{4}$	3	=	$\frac{1}{4}$	1 f.	=	$\frac{1}{12}$
4	0	=	$\frac{1}{5}$	2	=	$\frac{1}{6}$			
3	4	=	$\frac{1}{6}$	$1\frac{1}{2}$	=	$\frac{1}{8}$	Parts of a penny.		
2	6	=	$\frac{1}{8}$	1	=	$\frac{1}{12}$			
2	0	=	$\frac{1}{10}$				2 f.	=	$\frac{1}{2}$
1	8	=	$\frac{1}{12}$	Parts of sixpence.			1 f.	=	$\frac{1}{4}$
1	4	=	$\frac{1}{15}$						
1	3	=	$\frac{1}{16}$	3 farthings	=	$\frac{1}{8}$			
1	0	=	$\frac{1}{20}$	2 farthings	=	$\frac{1}{12}$			

Principle.—The value of any number of yards, &c. at one penny each, is exactly as many pence as there are yards, &c.; also at one shilling, or at one pound, the value is just as many shillings, or as many pounds. Hence the following rules.

RULE 1.—When the price is just the aliquot part of a penny, shilling, or pound, divide the quantity given, by the number expressed by such aliquot part. For instance, divide by 4 for $\frac{1}{4}$, by 3 for $\frac{1}{3}$, by 6 for $\frac{1}{6}$, &c.; and the quotient will be of the same name as that of which the part is taken.

Remember to proceed with any remaining pounds, shillings, and pence, as in Division of Money.

Examples.

What is the value of

$\frac{1}{4}|\frac{1}{4}|$5806 *yds.* at $\frac{1}{4}$d. ?

12) 1451$\frac{1}{4}$d. to be reduced.

2,0)12,0 11$\frac{1}{4}$d.

A. £6 0 11$\frac{1}{4}$d.

4d.$|\frac{1}{3}|$6782 *yds.* at 4d. ?

2,0)226,0s. 8d.

A. £113 0s. 8d.

3s. 4d.$|\frac{1}{6}|$4786 at 3s. 4d. ?

A. £797 13s. 4d.

6s. 8d.$|\frac{1}{3}|$2789 at 6s. 8d. ?

A. £929 13s. 4d.

OBSERVE.—*In the 1st example, the quotient is pence, because the yards are considered as being so many pence, the part taken being $\frac{1}{4}$ of a penny. In the 2nd, the quotient is shillings, because the yards are considered as shillings, the part taken being $\frac{1}{3}$ of a shilling. In the 3rd, the quotient is pounds, because the yards are considered as pounds, 3s. 4d. being $\frac{1}{6}$ of a pound. In the 1st, twopence remain, to be divided by 4. In the 2nd, two shillings remain, to be divided by 3. In the 3rd, four pounds remain, to be divided by 6. In the last, two pounds remain, to be divided by 3.*

What is the value of

6850 at 5*s.* ? *A.* £1712 10*s.*	4768 at 3*d.* *A.* £59 12*s.*	6812 at $\frac{1}{4}$*d.* *A.* £14 3*s.* 10*d.*
4786 at 10*s.* *A.* £2393.	7864 at 4*s.* *A.* £1572 16*s.*	6318 at 2*d.* *A.* £52 13*s.*
6831 at 6*s.* 8*d.* *A.* £2277.	1276 at 3*s.* 4*d.* *A.* £212 13*s.* 4*d.*	9167 at 1*s.* 8*d.* *A.* £763 18*s.* 4*d.*
7612 at $\frac{1}{4}$*d.* *A.* £7 18*s.* 7*d.*	3768 at 2*s.* 6*d.* *A.* £471.	8578 at 6*d.* *A.* £214 9*s.*

RULE 2.—When the price given, is not an aliquot part of a penny, or shilling, take some part of the price that is an aliquot part, and divide as in Rule 1; and for the remaining part of the price, take it from some foregoing part, and add the values together.

Examples.

$\frac{1}{2}$d. | $\frac{1}{2}$ | 7681 lbs. at $\frac{3}{4}$f. ?

$\frac{1}{4}$d. | $\frac{1}{2}$ | $3840\frac{1}{2}$ = value in pence at $\frac{1}{2}$d. per lb.
$1920\frac{1}{4}$ = do. do. at $\frac{1}{4}$f. do.

12)$5760\frac{3}{4}$ = do. do. at $\frac{3}{4}$f. do.

2,0) 48,0 $0\frac{3}{4}$d.

Answer £24 0s. $0\frac{3}{4}$d.

6d. | $\frac{1}{2}$ | 7610 yds. at $6\frac{3}{4}$d. ?

$\frac{3}{4}$f. | $\frac{1}{8}$ | 3805 = value in shillings at 6d. per yard.
475 $7\frac{1}{2}$ = do. do. at $\frac{3}{4}$f. do.

2,0)428,0 $7\frac{1}{2}$d. = do. do. at $6\frac{3}{4}$d. do.

A. £214 0s. $7\frac{1}{2}$d.

What is the value of

1861 at $1\frac{1}{4}$*d.* ? *A.* £9 13*s.* $10\frac{1}{4}$*d.*	7812 at $3\frac{1}{4}$*d.* *A.* £122 1*s.* 3*d.*	897 at $7\frac{1}{2}$*d.* *A.* £28 0*s.* $7\frac{1}{2}$*d.*
6128 at $3\frac{1}{2}$*d.* *A.* £82 19*s.* 8*d.*	1218 at $6\frac{1}{2}$*d.* *A.* £32 19*s.* 9*d.*	1260 at 11*d.* *A.* £57 15*s.* 0*d.*
6100 at $5\frac{3}{4}$*d.* *A.* £146 2*s.* 11*d.*	856 at $10\frac{1}{2}$*d.* *A.* £37 9*s.* 0*d.*	6121 at $11\frac{1}{2}$*d.* *A.* £286 18*s.* $5\frac{1}{2}$*d.*
764 at 9*d.* *A.* £28 13*s.* 0*d.*	6181 at $2\frac{1}{2}$*d.* *A.* £57 18*s.* $11\frac{1}{4}$*d.*	1234 at $11\frac{1}{4}$*d.* *A.* £59 2*s.* 7*d.*
1861 at $1\frac{1}{4}$*d.* *A.* £13 11*s.* $4\frac{1}{4}$*d.*	7000 at $4\frac{1}{4}$*d.* *A.* £123 19*s.* 2*d.*	2345 at $11\frac{1}{4}$*d.* *A.* £114 16*s.* $1\frac{1}{4}$d.

RULE 3.—When the price is more than one shilling but less than two, let the quantity be called shillings, and take parts for the rest of the price; and add the values together.

What is the value of

1d.	$\frac{1}{12}$	1281	at	13½d.	a pound?	
¼f.	¼	106 9	=	value at	1d.	a lb. in shillings.
		26 8¼	=	do. at	¼f.	do. do.
2,0)		141,4 5¼	=	do. at	13½d.	do. do.

A. £70 14*s.* 5¼d.

6d.	½	8765	at	19¾d.	a yard?	
1½d.	¼	4382 6	=	value at	6d.	in shillings.
		1095 7½	=	do. at	1½d.	do.
¼f.	$\frac{1}{6}$	182 7$\frac{1}{4}$	=	do. at	¼d.	do.
2,0)		1442,5 8¾	=	do. at	19¾d.	do.

A. £721 5*s.* 8¾d.

8100 at 1*s.* 4¾*d.*? *A.* £565 6*s.* 3*d.*	3450 at 1*s.* 5¾*d.* *A.* £225 3*s.* 1½*d.*	6789 at 1*s.* 6½*d.* *A.* £523 6*s.* 4½*d.*
6543 at 20¾*d.* *A.* £558 17*s.* 7½*d.*	3210 at 21½*d.* *A.* £284 4*s.* 4½*d.*	1000 at 21¾*d.* *A.* £90 12*s.* 6*d.*
6812 at 22¾*d.* *A.* £645 14*s.* 5*d.*	6760 at 23½*d.* *A.* £668 18*s.* 4*d.*	9990 at 23¾*d.* *A.* £988 11*s.* 10½*d.*
7951 at 1*s.* 9½*d.* *A.* £703 19*s.* 10¾*d.*	6437 at 1*s.* 6¾*d.* *A.* £502 17*s.* 9¾*d.*	9672 at 1*s.* 1½*d.* *A.* £544 1*s.* 0*d.*
4786 at 1*s.* 3¾*d.* *A.* £314 1*s.* 7½*d.*	7614 at 1*s.* 9½*d.* *A.* £682 1*s.* 9*d.*	1786 at 1*s.* 2¾*d.* *A.* £109 15*s.* 3½*d.*

RULE 4.—When the price is above two shillings, but under twenty; consider the quantity as so many shillings; multiply it by the number of shillings; take parts for the remainder of the price; and add the values together.

What is the value of

6d.	½	410 lbs. at 9s. 7¾d.?				
		9				
		3690 0	= value	at	9s. 0d.	in shillings.
1½d.	¼	205 0	= do.	at	0s. 6d.	do.
¼d.	1/6	51 3	= do.	at	0s. 1½d.	do.
		8 6½	= do.	at	0s. 0¼d.	do.
		2,0)395,4 9½	= do.	at	9s. 7¾d.	do.

Value £197 14 9½d.

2d.	1/6	846 at 18s. 2¼d.?				
		18				
¼d.	⅛	14688	= value	at	18s. 0d.	in shillings.
		136	= do.	at	0s. 2d.	do.
		17	= do.	at	0s. 0¼d.	do.
		2,0) 148,41	= do.	at	18s. 2¼d.	do.

V. £742 1s.

Examples.

1448 at 7*s.* 1¼*d.*? *V.* £515 17*s.* 0*d.*	7814 at 17*s.* 7*d.* *V.* £6869 16*s.* 2*d.*	3715 at 9*s.* 4¼*d.* *V.* £1741 8*s.* 1½*d.*
378 at 8*s.* 2¼*d.* *V.* £154 14*s.* 10½*d.*	3471 at 11*s.* 7¼*d.* *V.* £2017 10*s.* 4½*d.*	612 at 16*s.* 4¾*d.* *V.* £501 14*s.* 3*d.*
651 at 13*s.* 4¼*d.* *A.* £435 7*s.* 1½*d.*	764 at 11*s.* 5½*d.* *A.* £437 14*s.* 2*d.*	378 at 14*s.* 5½*d.* *A.* £273 5*s.* 3*d.*
725 at 15*s.* 3¾*d.* *A.* £555 1*s.* 6¼*d.*	472 at 18*s.* 6¼*d.* *A.* £438 1*s.* 6*d.*	372 at 19*s.* 11¾*d.* *A.* £371 12*s.* 3*d.*

RULE 5.—When the price consists of pounds, &c., call the given quantity pounds, multiply it by the pounds given, take parts of one pound for the rest of the price; and, if requisite, parts of parts, and add the values together.

What is the value of 4613 yds. at £1 5s. 7d.?

							£.	s.	d.
5s.	$\frac{1}{4}$	4613	0	0	=	value at	1	0	0
6d.	$\frac{1}{20}$	1153	5	0	=	do. at	0	5	0
1d.	$\frac{1}{6}$	115	6	6	=	do. at	0	0	6
		19	4	5	=	do. at	0	0	1
		£5900	15	11	=	do.	£1	5	7

							£.	s.	d.
10s.	$\frac{1}{2}$	391 yds. at £3 11s. 6½d.							
		3							
		1173	0	0	=	value at	3	0	0
1s.	$\frac{1}{20}$	195	10	0	=	do. at	0	10	0
6d.	$\frac{1}{2}$	19	11	0	=	do. at	0	1	0
½d.	$\frac{1}{12}$	9	15	6	=	do. at	0	0	6
		0	16	$3\frac{1}{2}$	=	do. at	0	0	$0\frac{1}{2}$
		£1398	12	$9\frac{1}{2}$	=	do.	£3	11	$6\frac{1}{2}$

575 at £2 7s. 6d.	623 at £1 14s. 6d.	548 at £1 8s. 1½d.
V. £1365 12s. 6d.	*V.* £1074 13s. 6d.	*V.* £770 12s. 6d.
342 at £4 15s. 4½d.	266 at £2 15s. 6d.	941 at £3 10s. 2d.
V. £1630 18s. 3d.	*V.* £738 3s. 0d.	*V.* £3301 6s. 10d.

RULE 6.—When there is ¼, ½, or ¾ with the given quantity, find the Values by the former rules, then take parts for the fraction, and add.

Examples.

5s. ¼ | 751¾ lbs. at £1 8s. 11d.

3s. 4d.	$\frac{1}{6}$	751	0	0	=	value of 751 lbs. at	1	0	0
		187	15	0	=	do. do.	0	5	0
5d.	$\frac{1}{8}$	125	3	4	=	do. do.	0	3	4
1d.	$\frac{1}{5}$	15	12	11	=	do. do.	0	0	5
		3	2	7	=	do. do.	0	0	1
		3	2	7	=	do. do.	0	0	1
		0	14	$5\frac{1}{2}$	=	do. ½ lb.			
		0	7	$2\frac{3}{4}$	=	do. ¼			
		£1086	18	$1\frac{1}{4}$	=	do. of 751¾ at	£1	8	11

530¼ at 3*s.* 6*d.*	546½ at 2*s.* 6*d.*
V. £92 17*s.* 7½*d.*	*V.* £68 6*s.* 3*d.*

RULE 7.—When the price is an even number of shillings, multiply the given quantity by half the price, and double the first figure of the product for shillings; carry the other figure, and the product of the rest will be pounds.

Examples.

856 at 8*s.*	1742 at 10*s.*	782 at 12*s.*
V. £342 8*s.*	*V.* £871	*V.* £469 4*s.*
171 at 14*s.*	342 at 16*s.*	356 at 18*s.*
V. £119 14*s.*	*V.* £273 12*s.*	*V.* £320 8*s.*

RULE 8.—When the price is an odd number of shillings under 20, multiply by the number of shillings, and reduce the product to pounds.

Examples.

1635 at 3*s.*	543 at 7*s.*	1224 at 9*s.*
V. £245 5*s.*	*V.* £190 1*s.*	*V.* £550 16*s.*
1210 at 11*s.*	1200 at 13*s.*	1571 at 17*s.*
V. £665 10*s.*	*V.* £780	*V.* £1335 7*s.*

RULE 9.—When the given quantity is of different denominations, multiply the price by the integers, and take parts of the price for odd quantities.

Aliquot parts.

16lbs. are $\frac{1}{7}$ cwt., 14lbs. are $\frac{1}{8}$ cwt., 8lbs. are $\frac{1}{14}$ cwt., 7lbs. are $\frac{1}{16}$ cwt. Also 10 cwts. = $\frac{1}{2}$ ton, 5 cwts. = $\frac{1}{4}$ ton, 4 cwts. = $\frac{1}{5}$ ton, 2½ cwts. = $\frac{1}{8}$ ton, 2 cwts. = $\frac{1}{10}$ ton.

Examples.

What is the value of 12cwts. 2qrs. 14lbs. at £3 14s. per cwt.?

		£.	*s.*	*d.*		*Cwt.*	*qr.*	*lb.*
2 qrs.	½	3	14	0				
				12				
		44	8	0	value of	12	0	0
14 lbs.	¼	1	17	0	do. of	0	2	0
		0	9	3	do. of	0	0	14
		£46	14	3	do. of	12	2	14

Cwt.	qr.	lb.		£.	s.	d.			Values. £.	s.	d.
5	1	0	at	2	17	0	per	cwt.	14	19	3
4	3	0	at	2	18	6		do.	13	17	10½
4	1	16	at	3	12	4		do.	15	17	9
Tons 68	1	21	at	4	16	0		do.	328	10	0
7 15	2	14	at	8	16	0		ton.	68	9	5¾

BILLS OF PARCELS.

Mr. James Hall, *Hull, July* 1, 1835.

Bought of John Smith,

	Cwt.	qr.	lb.		£.	s.	d.		
Currants	5	1	0	at	2	17	0	per	Cwt....
Sugar	17	3	19	at	2	2	6		do. ...
Soap	4	1	16	at	3	12	0		do. ...
Tobacco	12	2	14	at	3	14	0		do. ...

£115 11 4

Bought of Henry Oates.

				£.	s.	d.		
Rye	9 qrs.	7 bus.	at	1	15	6	per	qr....
Wheat	8 qrs.	6 bus.	at	1	19	0		do. ...
Beans	61 qrs.	5 bus.	at	1	13	6		do. ...

£137 16 3½

Bought of Anthony Jones.

	Oz.	dwts.	grs.		s.	d.	
A Silver Cup, weight	24	4	0	at	5	6	℔ oz.
A do. Teapot, do.	19	5	12	at	7	6	do.
24 do. Spoons, do.	51	15	12	at	5	10	do.

£28 17 8

TARE AND TRET.

TARE is a deduction from the whole weight, or Gross, for the weight of a cask or other package.

TRET is the deduction of 4lbs. in every 104, or $\frac{1}{26}$ part on account of dust, waste, &c.

SUTTLE is the remainder after Tare is deducted.

NEAT WEIGHT is that which remains after all deductions are made.

RULE 1.—Subtract the Tare from the Gross weight and the remainder will be the Neat.

Examples.

Gross 78cwts. 1qr. 13lbs.; Tare 1cwt. 1qr. 21lbs.; what is the Neat?

Gross 201cwts. 3qrs. 12lbs.; Tare 3140lbs.; what is the Neat? *A.* 173cwts. 3qrs. 8lbs.

RULE 2.—When the Tare is so much a cask, bag, &c. multiply the Tare by the number of casks, or bags, and subtract the product from the Gross.

Examples.

What is the Neat weight of 14 hogsheads of tobacco, weighing Gross 89cwts. 3qrs. 17lbs.; Tare per hogshead, 100lbs? *A.* 77cwts. 1qr. 17lbs.

What is the Neat weight of 30 bags, each 249lbs. Gross, Tare per bag 14lbs.? *A.* 7050lbs.

RULE 3.—When Tare is at so much per cwt. take aliquot parts of the Gross, and subtract the sum of them from the Gross, and the remainder will be the Neat Weight.

Aliquot parts of a Cwt. are 7lbs. $= \frac{1}{16}$, *8lbs.* $= \frac{1}{14}$, *14lb.* $= \frac{1}{8}$, *16lbs.* $= \frac{1}{7}$.

Examples.

What is the Neat Weight of 12 hogsheads, each 7cwts. 1qr. 10lbs., Tare per cwt. 21lbs.?

		cwt.	*qr.*	*lb.*	
		7	1	10	
				12	
lb.					
14	$\frac{1}{8}$	88	0	8	Gross weight of the whole.
7	$\frac{1}{2}$	11	0	1	Tare at 14 lbs.
		5	2	$0\frac{1}{2}$	do. at 7 lbs.
		16	2	$1\frac{1}{2}$	Tare of the whole.
	A.	71	2	$6\frac{1}{2}$	Neat.

What is the Neat weight of 30 barrels of figs, each 2cwt. 3qrs. Gross; Tare per cwt. 14lbs. ? *A.* 72cwt. 0qrs. 21lbs.

RULE 4.—When Tret is to be allowed, having deducted for Tare, divide the remainder, that is the Suttle, by 26, subtract the quotient from the Suttle, and the remainder will be the Neat weight.

Examples.

What is the Neat weight of 8cwt. 2qrs. 0lbs. Gross; allowing 21lbs. Tare per cwt. and Tret 4lbs. per 104lbs. ?

		cwt.	*qr.*	*lb.*	*oz.*	
14lbs.	$\frac{1}{8}$	8	2	0	0	Gross.
7lbs.	$\frac{1}{2}$	1	0	7	0	Tare at 14 lbs.
			2	3	8	do. at 7 lbs.
		1	2	10	8	Tare of the whole.
	26)	6	3	17	8	Suttle.
			1	1	12	Tret.
Answer		6	2	15	12	Neat.

In 4 casks of oil, each 3qrs. 10lb., Tare per cask 8lbs., Tret as usual, how many gallons Neat at 7½lbs. per gallon ? *A.* 44 $\frac{1}{15}$ gallons.

In 6 casks of oil each 2cwts. 3 qrs. 12lbs., Tare per cask 1qr. 4lbs., Tret as usual, how many gallons Neat at 7½lbs. per gallon ? *A.* 221$\frac{2}{15}$ gallons.

SIMPLE INTEREST

Is money paid for the use of money lent.

PRINCIPAL is the money lent.

RATE per cent. is the money agreed to be paid for the use of £100 for a year or per annum.

AMOUNT is the Principal and Interest added together.

The rules for Simple Interest serve for Commission, Insurance, Brokerage, &c.

RULE 1.—Multiply the Principal by the Rate per cent., and divide by 100; the quotient is the Interest for one year. Multiply the Interest for one year, by the number of years, and the product will be the Interest required for the time.

Examples.

What is the Amount of £215 for 4 years, at 5 per cent. for one year?

£.		£	s.
215	Interest for one year	10	15
5			4
1,00)10,75	Do. for four years	43	0
20	Principal	215	0
15,00	Amount	258	0

What is the Interest of £1000 at 4½ per cent. per annum, for 5 years?

What is the Amount of £40 10s. for 3 years at 3½ per cent. per annum? *A.* £44 15s.

What is the Commission on £675 at 2 per cent? *A.* £13 10s.

What is the Commission on £1275 at 2½ per cent? *A.* £28 13s. 9d.

What is the purchase of £250 Stock at 96¼ per cent.? *A.* £240 12s. 6d.

What is the Insurance on £300 at 10¼ per cent?

What is the Brokerage on £454 at 1¾ per cent.? *A.* £7 18s. 10¾d.

What is the Interest of £750 at 3½ per cent. *A.* £26 5s.

What is the Amount of £375 for 11 years at £5 per cent. per annum? *A.* £581 5s.

What is the Commission on £1025 at £2½ per cent.? *A.* £23 1s. 3d.

RULE 2.—When the rate is shillings and pence, or pounds, shillings, and pence, divide the given sum by 100, and the quotient will be the Commission, &c. at £1 per cent. From this quotient take aliquot parts and add.

Examples.

What is the Brokerage on £525 at £2 7s. 6d. per cent. ?

100)5,25
20

5,00

		£.	s.	d.		£	s.	d.
5s.	¼	5	5	0	Brokerage at 1 per Cent.			
				2				
		10	10	0	Do. at	2	0	0
2s. 6d.	¼	1	6	3	Do. at	0	5	0
		0	13	1½	Do. at	0	2	6
Answer		12	9	4½	Do. at	2	7	6

What is the Insurance on £375 at 7s. per cent. ? *A.* £1 6s. 3d.

What is the Factorage on £500 at 17s. 6d. per cent. ? *A.* £4 8s. 6d.

*** When there are months, take aliquot parts of one year's Interest, and add them together.

What is the Interest of £625 for one year and nine months at 5 per cent. per annum ? *A.* £54 13s. 9d.

What is the Interest of £725 for 10 months at 4 per cent. per annum ? *A.* £24 3s. 4d.

*** For weeks ; first find the Interest for one year ; then say, as 52 weeks : are to the Interest for one year, : : so are the given weeks : to the Interest required.

What is the Interest of £1000 for 14 weeks at 3½ per cent. per annum ? *A.* £9 8s. $5\frac{2}{5}\frac{8}{2}$d.

What is the Interest of £126 12s. for 16 weeks at 4½ per cent. per annum ? *A.* £1 14s. 10½d. and $\frac{10}{52}$f.

*** For days, say as 365 days : are to the Interest for one year, : : so are the given days : to the Interest required.

What is the Interest of £500 for 75 days at 5 per cent. per annum. ? *A.* £5 2s. 8¾d. and $\frac{188}{365}$ f.

What is the Interest of £200 for 5 years and 125 days at 5 per cent. per annum ? *A.* £53 8s. 5¾d. and $\frac{492}{365}$f.

COMPOUND INTEREST.

COMPOUND INTEREST is Interest on Interest, for the time the Interest remains unpaid.

RULE.—Having found, by the rule for Simple Interest, the Interest for the first year, add it to the Principal; then find the Interest of this Amount, and thus continue for every year of the given time. Subtract the Principal from the last Amount, and the remainder will be the Compound Interest.

Examples.

What is the Compound Interest of £150 forborn 3 years at 5 per cent. per annum ?

		£.	s.	d.
150	Interest for the first year	7	10	0
5	Principal	150	0	0
100)750	Amount	157	10	0
£7 10				5
		100)787	10	0
	Interest for the 2nd year	7	17	6
	Amount for the 1st do.	157	10	0
	Do. for the 2nd do.	165	7	6
				5
		100)826	17	6
	Interest for the 3rd year	8	5	4½
	Amount for the 2nd do.	165	7	6
	Do. for the 3rd do.	173	12	10½
	Principal	150	0	0
	Ans.—The Compound Interest is	23	12	10½

What is the Amount of £450 for 3 years at 5 per cent. per annum Compound Interest ? *A.* £520 18s. 7½d.

What is the Compound Interest of £400 10s. for 4 years at 3½ per cent. per annum ? *A.* £59 1s. 7½d.

DISCOUNT.

DISCOUNT is the allowance of a certain rate per Cent., for payment of money before it is due.

RULE.—Find the Amount of £100 at the Rate and Time given; then say, as that Amount : is to £100, : : so is the given sum : to the Present Worth. Subtract the Present Worth from the given sum, the remainder will be the Discount required.

Examples.

What is the Discount of £500 due 9 months hence, at 5 per cent. per annum?

	£.	s.
Interest of £100 at £5 for a year is	5	0
Do. do. do. for 6 months	2	10
Do. do. do. for 3 do.	1	5
Do. do. do. for 9 do.	3	15
	100	
Amount of £100 for 9 months	103	15

£.	s.		£.		£.		£.	s.	d.
As 103	15	:	100	: :	500	:	481	18	6½
20					20				
1075					10000				

	£.	s.	d.
Given Sum	500	0	0
Present Worth is	481	18	6½
Ans.—The Discount is	18	1	5½

What is the Present Worth of £810 due 3 months hence, Discount at 5 per cent. per annum? *A.* £800.

What is the Present Worth of a bill for £500 due 73 days after date, Discount at £4 per cent. per annum? *A.* £496 0s. 7½d. and $\frac{960}{2015}$ f.

What is the Discount of £250 for 2 months and 15 days at £4 per cent. per annum? *A.* £2 1s. 4d.

EQUATION OF PAYMENTS

Teaches how to find a mean time, at which a debt, due at different times, may be discharged at once, without disadvantage to either party.

COMMON RULE.

Multiply each payment by the time at which it is due, divide the sum of the products by the amount of the debt, the quotient is the time required.

Examples.

What is the equated time of £10, due at 2 months, £18 due at 3 months, and £22 due at 8 months ?

	10	×	2	=	20
	18	×	3	=	54
	22	×	8	=	176
Debt	50				5,0)25,0 Sum of the products.

Answer 5 Months.

What is the mean time for paying £100 at 1 week, £200 at 3 weeks, and £100 at 5 weeks ? *A.* 3 weeks.

I owe to B £100 payable in 50 days, £130 in 40 days, £230 in 140 days; at what time ought I to pay the whole together ? *A.* 92 $\frac{8}{46}$ days.

EXCHANGES.

EXCHANGES find how much money of one country is equal in value to a certain sum in another. The Par of Exchange is the true value of Foreign money compared with our own. The course of Exchange is sometimes above and sometimes below Par.

RULE.—Calculate by the Rule of Three, or by Practice.

AMSTERDAM, ROTTERDAM, ANTWERP, HAMBURGH, and ALTONA.

Exchanges at the first three of these places are computed in Florins or Guilders, Stivers and Pennings; at Hamburgh and Altona, in Marcs, Shillings, and Fennings.

8 Pennings	1	Grote or penny.
2 Grotes	1	Stivers.
12 Grotes	1	Shilling.
20 Shillings	1	Pound Flemish.
40 Grotes	1	Guilder or Florin.
12 Fennings	1	Shilling Lubec.
16 Shillings Lub.	1	Marc.

Examples.

How much Flemish money for £250 sterling; exchange at 35 shillings 10 grotes Banco per pound sterling?

		£.	s.	gr.
6	½	250 at	35	10
4	⅓	35		
		1250		
		750		
		8750		
		125		
		83	4	
		2,0)895,8	4	

Also 8958 4 / 12 / 40)107500 grotes. / 2687 flo. 20 gro.

Answer £447 18s. 4d. Flemish.

Or 2687 flo. 20 grotes.

What is the value in sterling money of 3750 florins Banco, at 36 shillings Banco per pound sterling? *A.* £347 4s. 5¼d. and $\frac{144}{432}$ f.

How many florins Banco can I have for £1000 sterling, exchange at 36sh. 10 grotes Banco per pound sterling? *A.* 11050 florins.

How much sterling for 1473 marcs 14sh. Banco, Hamburgh, exchange at 13m. 14s. per pound sterling? *A.* £106 4s. $6\frac{12}{272}$d.

How many marcs, &c. Banco, Altona, for £150 sterling, exchange at 13m. 14s. per pound sterling? *A.* 2081 marcs 4 shillings?

At Amsterdam and some other places the current money is not so valuable as bank-money; sometimes 100 *banco are worth* 120 *currency. The difference is called Agio which varies.*

To turn bank-money into currency state thus; as 100 : is to 100 with the agio added to it, : : so is the bank-money : to the value in currency.

And to change currency into banco say, as 100 with the agio added to it : is to 100, : : so is the given currency to the banco.

How much banco for £1000 Flemish currency, agio at 5 per cent? *A.* £952 7sh. 7 grotes.

Change 500 guilders banco into currency, agio at 6 per cent. *A.* 530.

SWEDEN.

Exchanges are generally computed in Rix-dollars, Skillings, and Fennings.

12 Fennings	=	1 Skilling.
48 Skillings	=	1 Rix-dollar.

Examples.

In 1500 rix-dollars 30 skillings, how many pounds sterling, exchange at 4 rix-dollars per pound sterling? *A.* £375 3s. 1½d.

How many rix-dollars, &c. for £500 sterling, exchange at 4¼ rix-dollars per pound sterling? *A.*

DENMARK.

Exchanges here are generally computed in Rix-dollars, Marcs, and Skillings Danish, and sometimes in Rix-dollars, Marcs, and Sols Lub. of Hamburgh.

16 Skillings		= 1 Marc.
6 Marcs Danish	= 3 Marcs Lub	= 1 Rix-dollar Lub.
3 Skillings Danish		= 1 Sol Lub.

Examples.

In £48 15s. 10d. sterling, how many rix-dollars, &c. of Denmark, exchange at 47d. sterling per rix-dollar? *A.* 249 rix-dol. 0m. 14 $\frac{14}{47}$sk.

In 400 rix-dollars, 2 marcs, 15 skillings Danish, how much sterling, exchange at 45d. per rix-dollar?

A. £75 1s. 10$\frac{3}{95}$d.

PETERSBURG.

Exchanges here are generally computed in Roubles and Copecs.

4 Poluscas	=	1 Copec.
10 Copecs	=	1 Grivener.
100 Copecs or 10 Griveners	=	1 Rouble.

Examples.

In 745 roubles 50 copecs, how many pounds sterling, exchange at 4s. 9d. per rouble? *A.* £177 1s. 1½d.

In £1000 sterling, how many roubles, &c., exchange at 3s. 10½d. per rouble ? *A.* 5161 rou. 29 $\frac{3}{93}$ co.

How much sterling for 10000 roubles, exchange at 10½d. per paper rouble ?

FRANCE.

Exchanges here are computed in Francs and Centimes.

100 Centimes = 1 Franc.

Examples.

How many francs for £600 sterling, at 25 francs per pound sterling ?

At 25 francs, 25 centimes per pound sterling, how much sterling for 4000 francs 50 centimes ?

A. £158 8s. 8½d.

How many francs and gold napoleons for 300 sovereigns, at 25 francs 25 centimes per sovereign, the napoleon being 20 francs ? *A.* 7575fr. 378nap. 15fr.

VENICE.

Accompts are kept in Lire, Soldi, and Denarii.

12 Denarii = 1 Soldi.
20 Soldi = 1 Lire.

Examples.

How many lire for £500 sterling at 45½ lire per pound sterling ? *A.* 22750 lire.

Change 2750 lire into sterling money at 47¼ lire per pound. £57 17s. 10½d. and $\frac{90}{95}$ f.

NAPLES.

Exchanges are computed in Ducats and Grani di Regno ; or in Ducats, Carlini, and Grani.

10 Grani = 1 Carlini.
10 Carlini = 1 Ducat Regno.
100 Grani = 1 Ducat Regno.

How much sterling money for 1200 ducats di regno at 45 pence per ducat ? *A.* £225.

How many ducats, &c. for £500 sterling at 44 pence per ducat ? *A.* 2727du. 2car. 7 $\frac{12}{44}$gra.

MADRID.

Exchanges are here computed in Reals and Marvedies.

34 Marvedies = 1 Real.
8 Reals = 1 Piastre or Dollar.

How many piastres for £100 sterling, at 37½d. per piastre? *A.* 644pi. 2re. 12 $\frac{48}{170}$mar.

How many pounds for 900 piastres, exchange at 40½d. per piastre? *A.* £150 18s. 9d.

LISBON.

Exchanges here are computed in Mille-reis and Reis.

1000 Reis = 1 Mille-Reis.

Examples.

How much Portuguese money for £70 6s. 3d., exchange at 67½d. per mille-reis? *A.* 250 mille-reis.

In 2500 mille-reis how much sterling at 54½d. per mille-reis? *A.* £565 2s. 1d.

RULE OF FIVE.

This rule teaches by means of five terms given, to find a sixth. Of the five terms given, three are always a supposition; and with two terms a demand is made.

RULE.—Of the three terms of supposition, place that first which is the principal cause of loss, gain, or action; place that second which denotes time or distance; and that the third which is the gain or loss. Then write each of the two terms of demand under its like, and number the five terms, as in the following example. When the blank place is under the third term, multiply the third, fourth, and fifth terms together for a dividend, and the first and second for a divisor; but if the blank is under the first or second term, multiply the first, second, and fifth terms together for a dividend, and the remaining two for a divisor; the quotient will be the answer.

Remember × *signifies multiplied by; and* = *equal to.*

If £100 gains £5 in 12 months, how much will £400 gain in 3 months?

1st.		2nd.		3rd.
£100	,	12 months	,	£5
4th.		5th.		
£400	,	3 months.		

$5 \times 400 \times 3 = 6000$, the Dividend.
$100 \times 12 = 1200$, the Divisor.

1200) 6000(5

Answer £5.

If £70 gain £22 in 9 years, how much will £140 gain in 6 years at the same rate? *A.* £29 6s. 8d.

If £700 in 6 months lose £14, how much will £400 lose in 5 years at the same rate? *A.* £80.

If 7 men can reap 70 acres of wheat in 12 days, how many men can reap 100 acres in 5 days? *A.* 24 men.

If 10 bushels of oats be enough for 18 horses 20 days; how many bushels will serve 60 horses 36 days?

A. 60 bushels.

Suppose 56lbs. of bread to be sufficient for 7 men 14 days, how much bread will serve 21 men 3 days?

A. 36lbs.

Suppose 7 oz. of bread cost † 1d. when wheat is * 40s. a quarter, what should be paid for 10 oz. when wheat is 42s. a quarter? *A.* $1\frac{1}{2}$d.

If a footman travel † 240 miles in 12 days when the days are * 12 hours long, in how many days of 16 hours, could he travel 720 miles? *A.* 27 days.

If * 5000 copies of a book of $12\frac{1}{2}$ sheets require † 125 reams of paper, how much paper will be sufficient for 3000 copies of 11 sheets? *A.* 66 reams.

* Denotes the 1st term. † the 3rd.

FRACTIONS.

Fractions are parts of some integer, quantity, or number. Thus, farthings are fractions of a penny; pence of a shilling; inches are fractions of a foot; ounces are fractions of a pound, &c.

In common use, there are three kinds of fractions; Vulgar, Decimal, and Duodecimal.

VULGAR FRACTIONS.

A VULGAR FRACTION expresses a part or parts of some quantity, by means of two numbers, placed one over the other, with a line between them; as $\frac{1}{7}$, which is read one seventh. The number above the line is called the numerator, and that below, the denominator. The denominator expresses how many parts the integer or whole is divided into, and the numerator shows how many such parts the fraction consists of. As $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{17}$, &c., one fourth, one fifth, &c. In common, there are three kinds of vulgar fractions; viz., proper, improper, and compound. A proper fraction's numerator is less than its denominator, as $\frac{1}{3}$, $\frac{4}{7}$, $\frac{3}{11}$. An improper fraction's numerator is equal to, or greater than its denominator; as $\frac{3}{3}$, $\frac{5}{5}$, $\frac{17}{15}$. A compound fraction is a fraction of a fraction, as $\frac{1}{3}$ of $\frac{2}{3}$. A whole number and a fraction, as $3\frac{1}{3}$, make what is called a mixt number.

The denominator is always a divisor; and $\frac{14\frac{1}{3}}{7\frac{1}{2}}$, *by some called a complex fraction, means only that* $14\frac{1}{3}$ *is divided by* $7\frac{1}{2}$.

REDUCTION.

Problem 1.—To reduce a given quantity to the fraction of its integer, or to the fraction of a greater quantity of the same kind.

RULE.—If the quantity given consists of one denomination, reduce the integer to the same denomination for a denominator; but if the quantity given is of several denominations, reduce it to its lowest denomination for a numerator, and the integer to the same for a denominator.

Examples.

Reduce 19s. to the fraction of a pound.

£1 is 20s. Hence $£\frac{19}{20}$ is the fraction required.

Reduce 3qrs. 14lbs. to the fraction of a cwt.

3qrs. 14lbs.
28
—
98lbs. the numerator.
—

and 1 cwt. × 112 is the denominator. Then $\frac{98}{112}$ is the fraction required.

Reduce 17s. 9¾d. to the fraction of a sovereign. $\frac{855}{960}$ sov.

What part of a guinea is 12s. 4½d. ? A. $\frac{594}{1008}$ g.

What part of a crown is 3s. 7¼d. ? A. $\frac{216}{240}$ cr.

What part of a pound Troy is 3 oz. 15 dwt. 20 grs. ? A. $\frac{1820}{5760}$ lb.

What part of a cwt. is 2 qrs. 21 lbs. ? A. $\frac{77}{112}$ cwt.

What part of a yard is 3 qrs. 2 nails ? A. $\frac{14}{16}$ yd.

What part of a mile is 3 fur. 30 poles ? A. $\frac{825}{1760}$ mile.

What part of an acre is 3 ro. 20 perches, 20 yards ? A. $\frac{4255}{4340}$ acre.

What part of a hhd. of wine is 16gals. 3qts. ? A. $\frac{67}{252}$.

What part of a square yard is 2 sq. ft. 30 sq. inches ? A. $\frac{318}{1296}$ yard.

What part of a last of corn is 3qrs. 6bus. ? A. $\frac{30}{80}$ last.

What part of a month of 28 days, is 3 weeks 3 days 12 hours ? *A.* $\frac{588}{672}$ month.

OBSERVE.—*A fraction is in its least terms, when both its numerator and denominator can be divided by no number, but one, without a remainder. Thus* $\frac{3}{7}$ *and* $\frac{11}{15}$ *are in their least terms, but* $\frac{6}{12}$ *and* $\frac{25}{30}$ *are not.*

Problem 2.—To reduce a proper fraction to its least terms.

RULE.—Divide the denominator by the numerator, and this divisor by the remainder, and continue until nothing remains. Divide both the terms of the fraction by the last divisor, and the quotients are the new terms of the required fraction. When the last divisor is one, the fraction is already in its least terms.

Reduce $\frac{182}{196}$ to its least terms.

182)196(1
182

14)182(13
14

42
42

. . Facit $\frac{13}{14}$

14)$\frac{182}{196}$($\frac{13}{14}$

Reduce $\frac{825}{2700}$ F. $\frac{275}{900}$.

Reduce $\frac{77}{112}$cwt. F. $\frac{11}{16}$cwt.

Reduce $\frac{1823}{5760}$lb. F. $\frac{91}{288}$lb.

Reduce $\frac{318}{1296}$yd. F. $\frac{53}{216}$yd.

Reduce $\frac{465}{960}$£. F. $\frac{31}{64}$£.

Reduce $\frac{98}{112}$cwt. F. $\frac{7}{8}$c.

Reduce $\frac{855}{960}$sov. F. $\frac{57}{64}$s.

Reduce $\frac{593}{1008}$gui. F. $\frac{33}{56}$g.

Reduce $\frac{216}{240}$cro. F. $\frac{9}{10}$cr.

Reduce $\frac{825}{1760}$mile F. $\frac{15}{32}$mi.

Reduce $\frac{661}{2560}$hhd. F. $\frac{11}{42}$h.

Reduce $\frac{577}{672}$mon. F. $\frac{7}{8}$mo.

Problem 3.—To find the value, or proper quantity of a fraction.

RULE.—Multiply the numerator by the integer, or its parts, and divide by the denominator.

Examples.

What is the value of $\frac{7}{8}$£ ?

7
20
—
8)140
—
17s. 6d. Ans.

What is the value of $\frac{1}{6}$ of 14s. 6d ?

14 6
5
—
6)72 6
—
12s. 1d. Ans.

What is the value of

$\frac{365}{960}$ £. ? A. 9s $8\frac{1}{2}$d.
$\frac{98}{112}$ cwt. ? A. 3qr. 14lbs.
$\frac{57}{64}$ sov. ? A. 17s. $9\frac{3}{4}$d.
$\frac{33}{56}$ guinea ? A. 12s. $4\frac{1}{2}$d.
$\frac{9}{10}$ crown ? A. 4s. 6d.
$\frac{14}{10}$ yard ? A. 3qr. 2nls.
$\frac{11}{16}$ cwt. ? A. 2qr. 21lbs.
$\frac{42555}{48840}$ acre ? A. 3r. 20p.30yd
$\frac{53}{2160}$ sq. yd. ? A. 2sq. ft. 30in.
$\frac{67}{2552}$ hhd ? A. 16 gal. 3 qts.
$\frac{30}{40}$ last ? A. 3qrs. 3bus.
$\frac{7}{8}$ mon. ? A. 3wks. 3d. 12hrs.

What is the proper quantity of $\frac{91}{277}$lb. Troy ?
A. 3oz. 15dwt. 20gr.

Problem 4.—To reduce a fraction of one denomination to the fraction of another but greater, retaining the same value of the same coin, weight, or measure.

RULE.—Multiply the denominator by as many of the less denomination as make one of the greater, for a new denominator, and place it under the given numerator. Reduce this new fraction to its least terms by Problem 2.

Examples.

Reduce $\frac{5}{9}$ farthing to the fraction of a pound.

9
960f. $\frac{5}{8640}$ which reduced.
—
8640 D. is $\frac{1}{1728}$£.
—

Reduce $\frac{6}{7}$ lb. to the fraction of a cwt.

7
112lb. $\frac{6}{784}$ which reduced.
—
784 D. is $\frac{3}{392}$ cwt.
—

Reduce $\frac{5}{6}$ of a penny to the fraction of a pound.
Facit $\frac{1}{288}$£.

Reduce $\frac{6}{7}$ of a pound to the fraction of a cwt.
Facit $\frac{3}{392}$ cwt.

Reduce $\frac{5}{6}$ gal. to the fraction of a hhd. of wine.
Facit $\frac{5}{378}$ hhd.

Problem 5.—To reduce a fraction of one denomination to the fraction of another but less, retaining the same value of coin, weight, or measure.

RULE.—Multiply the numerator by as many of the less denomination as make one of the greater, for a new numerator, which place over the given denominator, and reduce this new fraction to its least terms by Prob. 2.

Reduce $\frac{1}{1920}$ of a pound to the fraction of a farthing.
Facit $\frac{5}{9}$.

Reduce $\frac{1}{288}$ of a pound to the fraction of a penny.
Facit $\frac{5}{6}$d.

Reduce $\frac{3}{392}$ of a cwt. to the fraction of a lb.
Facit $\frac{6}{7}$ lb.

Reduce $\frac{1}{728}$ of a hhd. of wine to the fraction of a pint. Facit $\frac{9}{13}$ pint.

Problem 6.—To reduce a fraction of one denomination to the fraction of another of the same kind of coin, weight, or measure, when a certain number of the less is not exactly contained in the greater.

RULE.—Reduce the given fraction to its proper quantity by Prob. 3, then reduce this quantity to the fraction required by Prob. 1, and by Prob. 2, reduce the last fraction to its least terms.

Reduce $\frac{5}{8}$ of a shilling to the fraction of 6s. 8d.

By Prob. 3. 5 / 12 — 8)60 — $7\frac{1}{2}$d. to be reduced.

by Prob. 1. $7\frac{1}{2}$ / 4 — 30 f. N.

6s. 8d. / 12 — 80 / 4 — 320 f. D.

$\frac{30}{320}$ reduced by Prob. 2 is $\frac{3}{32}$.

Reduce $\frac{1}{8}$ of a crown to the fraction of a guinea.
Facit $\frac{25}{168}$.

What part of a groat is $\frac{1}{6}$ of three halfpence. A. $\frac{3}{16}$.

Problem 7.—To reduce a mixed number to an improper fraction.

RULE.—Multiply the whole number by the denominator of the fraction, to the product add the numerator, which place over the given denominator.

Reduce $12\frac{15}{17}$ to an improper fraction. Facit $\frac{219}{17}$.

Reduce $18\frac{8}{11}$. F. $\frac{206}{11}$. | Reduce $16\frac{18}{100}$. F. $\frac{1618}{100}$.

Reduce $79\frac{12}{19}$. F. $\frac{1513}{19}$. | Reduce $100\frac{3}{59}$. F. $\frac{5903}{59}$.

Problem 8.—To reduce an improper fraction to its proper terms.

RULE.—Divide the numerator by the denominator.

Reduce $\frac{5903}{59}$. F. $100\frac{3}{59}$. | Reduce $\frac{141}{17}$. F. $8\frac{5}{17}$.

Reduce $\frac{16118}{103}$. F. | Reduce $\frac{961}{17}$. F. $56\frac{9}{17}$.

Problem 9.—To reduce a compound fraction to its simple one.

RULE.—Multiply all the numerators together for a new numerator, and all the denominators for a new denominator; and reduce the new fraction, if improper, by Prob. 8, to its least terms by Prob. 2.

NOTE.—*To express a whole number fractionally put* 1 *for a denominator thus,* 7 *is* $\frac{7}{1}$.

OBSERVE.—For × read, multiplied by, and for = equal to.

Reduce $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$ to a simple fraction.

$1 \times 2 \times 3 = 6$ Numerator.

$2 \times 3 \times 4 = 24$ Denominator, $\frac{6}{24}$ reduced is $\frac{1}{4}$.

Reduce $\frac{7}{8}$ of $\frac{2}{3}$ of $\frac{9}{10}$. F. $\frac{21}{40}$. | Reduce $\frac{1}{2}$ of $\frac{1}{6}$ of $\frac{7}{8}$. F. $\frac{7}{96}$.

Reduce $\frac{1}{9}$ of $\frac{18}{20}$ of 9. F. $\frac{9}{10}$. | Reduce $\frac{2}{3}$ of $\frac{1}{7}$ of 12. F. $1\frac{1}{7}$.

Problem 10.—To reduce fractions to a common denominator.

RULE.—Multiply each numerator into all the denominators except its own for a new numerator, and all the denominators together for a common denominator.

Reduce $1\frac{4}{7}$, $\frac{7}{8}$ and $\frac{3}{5}$ to a common denominator.

$4 \times 9 \times 8 = 288$
$7 \times 5 \times 8 = 280$ } New numerators.
$3 \times 5 \times 9 = 135$

$5 \times 9 \times 8 = 360$ Common denominator.

Facit $1\frac{288}{360}$, $\frac{280}{360}$, and $\frac{135}{360}$.

Reduce to a common denominator

$\frac{1}{8}, \frac{1}{5}$ & $\frac{2}{7}$. F. $\frac{35}{105}, \frac{25}{105}$ & $\frac{30}{105}$ | $\frac{7}{8}, \frac{1}{8}$ & $2\frac{3}{8}$. F. $\frac{42}{48}, \frac{24}{48}$ & $2\frac{32}{48}$

$3\frac{1}{9}, \frac{2}{3}$ & $\frac{3}{8}$. F. $3\frac{24}{216}, \frac{144}{216}$ & $\frac{81}{216}$ | $\frac{1}{7}, \frac{3}{8}$ & $7\frac{1}{9}$. F. $\frac{27}{189}, \frac{126}{189}$ & $7\frac{21}{189}$

ADDITION.

RULE 1.—If the fractions are of like denominators and denominations, add the numerators together, and put their sum over the denominator. When the new fraction is an improper one, reduce it by Problem 8, Reduction: and, if requisite, reduce it to its least terms by Problem 2.

Examples.

	$\frac{1}{4}$	$\frac{5}{13}$	$\frac{2}{9}$	$1\frac{2}{7}$	$\frac{1}{5}$	$\frac{1}{8}$
	$\frac{2}{4}$	$\frac{6}{13}$	$\frac{5}{9}$	$\frac{4}{7}$	$2\frac{3}{5}$	$\frac{5}{8}$
	$\frac{3}{4}$	$\frac{8}{13}$	$1\frac{7}{9}$	$\frac{3}{7}$	$\frac{4}{5}$	$1\frac{7}{8}$
Sum	$\frac{6}{4}$	$\frac{19}{13}$	$1\frac{14}{9}$			
Facit	$1\frac{1}{2}$	$1\frac{6}{13}$	$2\frac{5}{9}$	$2\frac{2}{7}$	$3\frac{3}{5}$	$2\frac{5}{8}$

RULE 2.—If the given fractions have not like denominators, reduce them to common denominators by Problem 10, then add the numerators together and reduce as directed in the last Rule.

What is the sum of $\frac{4}{7}$s. and $\frac{13}{24}$s. ?

$4 \times 24 = 96$
$13 \times 7 = 91$ } New numerators.
$7 \times 24 = 168$ Common denominator.

The new fractions are $\frac{96}{168}$ and $\frac{91}{168}$.

Their sum is $\frac{187}{168}$ which reduced by Problem 8,

thus 168)187($1\frac{19}{168}$ is the answer.

What is the sum of

$\frac{3}{7}$£, $\frac{3}{8}$£, and $\frac{1}{2}$£ ? *A.* $1\frac{25}{42}$£. | $\frac{1}{5}$d. $\frac{2}{7}$d. $\frac{3}{4}$d. & $\frac{1}{8}$d ? *A.* $1\frac{36}{70}\frac{3}{5}$d.

$\frac{4}{5}$, $\frac{3}{4}$, $\frac{5}{6}$, and $\frac{7}{8}$? *A.* $3\frac{1}{8}$£. | $\frac{3}{8}$lb $\frac{1}{6}$lb $\frac{1}{2}$lb & $\frac{3}{4}$lb ? *A.* $2\frac{1}{12}$lb.

$\frac{1}{4}$, $\frac{2}{5}$, $\frac{2}{7}$, and $\frac{1}{4}$? *A.* $1\frac{61}{140}$£. | $\frac{1}{7}$, $\frac{7}{8}$, $\frac{1}{2}$, & $\frac{1}{8}$? *A.* $1\frac{143}{168}$lb.

RULE 3.—Reduce compound fractions to simple ones by Problem 9, and proceed with them as already directed.

NOTE.—+ *signifies added to,* = *equal to.*

Examples.

Add $\frac{1}{3}$ of $\frac{4}{5}$ and $\frac{6}{7}$ together.

By Problem 9, $\frac{1}{3}$ of $\frac{4}{5} = \frac{4}{15}$. Then $\frac{4}{15}$ and $\frac{6}{7}$ reduced by Problem 10, are $\frac{28}{105}$ and $\frac{90}{105}$. By Rule 1, $\frac{28}{105} + \frac{90}{105} = \frac{118}{105}$, which reduced by Problem 8, is $1\frac{13}{105}$.

What is the sum of

$\frac{1}{3}$ of $\frac{1}{4}$ and $\frac{2}{3}$ of $\frac{1}{4}$? *A.* $\frac{1}{3}$ | $\frac{2}{3}$ of $\frac{1}{4}$ and $\frac{1}{5}$ of $\frac{2}{7}$? *A.* $\frac{47}{210}$.

$\frac{5}{7}$ and $\frac{1}{2}$ of $\frac{1}{3}$ of $\frac{2}{5}$? *A.* $\frac{82}{105}$. | $\frac{1}{5}$ of 7 and $\frac{1}{2}$ of $\frac{1}{2}$? *A.* $1\frac{17}{30}$.

Rule 4.—When the given fractions are of different denominations of money, weight, &c. and their sum is not required to be fractionally expressed, find the value of each fraction by Problem 3, and add the values together.

Examples.

What is the sum of $\frac{4}{7}$ of a Ton, and $\frac{9}{10}$ of a Cwt?

Prob. 3, $\frac{4}{7}$ of 20 = 7)80cwt. = 11 1 20

$\frac{9}{10}$ of 4 = 10)36 = 3 16 12 $12\frac{8}{10}$ by Prob. 2, $\frac{8}{10} = \frac{4}{5}$.

		cwts.	*qrs.*	*lbs.*	*oz.*	*dwts.*
Whence	$\frac{4}{7}$ Ton =	11	1	20	0	0
And	$\frac{9}{10}$ Cwt. =	0	3	16	12	$12\frac{4}{5}$
	Sum	12	1	8	12	$12\frac{4}{5}$

Examples.

What is the sum of $\frac{3}{8}$ cr. $\frac{5}{12}$ £. and $\frac{4}{7}$ of a guinea?
A. £1 2s. $2\frac{4}{7}$d.

What is the sum of $\frac{3}{8}$ yd. $\frac{3}{4}$ ft. and $\frac{1}{8}$ of a mile?
A. 1540yds. 2ft. 9in.

What is the sum of $\frac{1}{3}$ wk. $\frac{1}{4}$ day, and $\frac{1}{2}$ of an hour?
A. 2 days $14\frac{1}{2}$ hours.

SUBTRACTION.

Rule 1.—If the fractions are of like denominations and have a common denominator, take the less numerator from the greater, and under the difference place the com-

mon denominator, and if requisite reduce the fraction to its least terms. Prove every example by Addition.

From	$\frac{7}{9}$£.	$\frac{10}{11}$s.	$\frac{21}{75}$d.	$\frac{121}{367}$f.	$\frac{567}{1061}$
Take	$\frac{1}{9}$£.	$\frac{5}{11}$s.	$\frac{14}{75}$d.	$\frac{101}{367}$f.	$\frac{127}{1061}$
Remainders	$\frac{6}{9}$				

RULE 2.—When mixed numbers are given, and the fraction to be subtracted is greater than the one from which you have to subtract, the denominators being common, take the numerator of the greater from the denominator, and add to the remainder, the numerator of the less, for a new numerator, carrying one to be subtracted as in subtraction of integers.

From	$2\frac{1}{8}$	$6\frac{3}{16}$	$19\frac{7}{18}$	$25\frac{2}{37}$	5	7
Take	$1\frac{5}{8}$	$2\frac{11}{16}$	$13\frac{13}{18}$	$9\frac{14}{37}$	$1\frac{1}{4}$	$4\frac{5}{7}$
Remainders	$\frac{4}{8}$	$3\frac{8}{16}$				
Facits	$\frac{1}{2}$	$3\frac{1}{2}$				

RULE 3.—If the fractions have not a common denominator, reduce them to a common denominator and subtract as directed in Rule 1.

From $\frac{97}{100}$£ take $\frac{3}{7}$£ R. $\frac{379}{700}$ | From $5\frac{5}{36}$ take $\frac{3}{4}$ of 2. R. $3\frac{23}{36}$
From $\frac{4}{5}$£ take $\frac{9}{20}$£ R. $\frac{7}{20}$ | From $\frac{2}{3}$ of $\frac{1}{5}$ take $\frac{1}{9}$ of $\frac{1}{5}$. R. $\frac{1}{9}$

RULE 4.—When the fractions are of different denominations of money, weight, &c. and their difference is not required to be fractionally expressed, reduce each fraction to its proper quantity by Prob. 3, and subtract.

From $\frac{3}{4}$ of a pound take $\frac{2}{3}$ of a shilling. *A.* 14s. 7d. $\frac{4}{5}$f.
From $\frac{4}{7}$ of a guinea take $\frac{1}{3}$ of a pound. *A.* 5s. 4d.
From $\frac{4}{5}$ oz. take $\frac{3}{8}$ dwt. *A.* 15 dwts. 15 grs.
From $3\frac{1}{2}$ cwts. take $15\frac{9}{10}$ lbs. *A.* 3 cwts. 1 qr. $12\frac{1}{10}$lbs.

MULTIPLICATION.

RULE 1.—Multiply all the numerators both of simple and compound fractions together for a new numerator; and all the denominators together for a new denominator; and reduce this fraction to its least terms by Prob. 2, for the product required.

Mult. $\frac{4}{5}$ by $\frac{4}{7}$. Prod. $\frac{3}{7}$. | Mult. $\frac{3}{4}$ by $\frac{3}{11}$. P. $\frac{9}{77}$.
Mult. $\frac{4}{5}$ by $\frac{3}{8}$. Prod. $\frac{1}{6}$. | Mult. $\frac{1}{4}$ by $\frac{2}{3}$ of $\frac{1}{5}$. P. $\frac{1}{30}$.
Mult. $\frac{3}{10}$ by $\frac{5}{18}$. & $\frac{7}{12}$ Pro. | Mult. $\frac{1}{9}$ of $\frac{7}{8}$ by $\frac{1}{2}$ & $\frac{6}{7}$. P. $\frac{1}{24}$.

RULE 2.—Reduce mixed numbers to improper fractions by Prob. 7, and proceed with them and compound fractions as in the last Rule.

NOTE.—*To express a whole number fractionally, put* 1 *for a denominator as* $9=\frac{9}{1}$.

Mult. $4\frac{7}{10}$ by $\frac{3}{8}$ of $\frac{3}{4}$. Pro. $2\frac{7}{16}$. | Mult. $48\frac{1}{4}$ by $\frac{1}{3}$ of $\frac{1}{5}$. P. $3\frac{13}{60}$.
Mult. $48\frac{1}{4}$ by 7 Pro. $337\frac{3}{4}$. | Mult. $7\frac{1}{4}$ by $8\frac{1}{2}$ P. $61\frac{1}{8}$.

DIVISION.

RULE 1.—When the numerator of the divisor divides the numerator of the dividend, and the denominator of the divisor divides the denominator of the dividend, both exactly without a remainder, the quotients placed properly will make the fraction required.

Examples.

Divide $\frac{3}{14}$ by $\frac{3}{7}$. Quotient $\frac{1}{2}$. | Divide $\frac{16}{45}$ by $\frac{4}{5}$. Quotient
Divide $\frac{4}{5}$ by $\frac{2}{3}$. Quotient | Divide $\frac{3}{4}$ by $\frac{1}{2}$. Quotient $1\frac{1}{2}$.

RULE 2.—Multiply the denominator of the divisor by the numerator of the dividend for a new numerator, and the numerator of the divisor, by the denominator of the dividend for a new denominator. Reduce the fraction and you will have the quotient required.

Examples.

Divide $\frac{11}{12}$ by $\frac{5}{6}$. Q. $1\frac{1}{10}$. | Divide 64 by 132. Q. $\frac{16}{33}$.
Divide $\frac{17}{21}$ by $\frac{3}{5}$. Q. $1\frac{22}{63}$. | Divide 132 by 64. Q. $2\frac{1}{16}$.
Divide $\frac{2}{3}$ by 4. Q. $\frac{1}{6}$. | Divide 4 by $\frac{2}{3}$. Q. 6.

RULE 3.—Reduce mixed numbers to improper fractions, and compound fractions to simple ones, and proceed as directed in Rules 1, and 2.

Examples.

Divide $14\frac{3}{4}$ by $7\frac{1}{2}$.

By Problem 8.—$14\frac{3}{4}$ by $7\frac{1}{2} = \frac{59}{4}$ by $\frac{15}{2}$.

Then by Rule 2, $\frac{59}{4} \times \frac{2}{15} = \frac{118}{60}$ reduced is $1\frac{58}{60} = 1\frac{29}{30}$ the Q.

Divide $56\frac{1}{7}$ by $3\frac{1}{2}$. Quotient $16\frac{2}{49}$.
Divide $8\frac{3}{4}$ by $\frac{1}{8}$ of $\frac{9}{11}$. Quotient $32\frac{1}{11}$.
Divide $\frac{3}{5}$ of $\frac{1}{3}$ by $\frac{2}{7}$ of $\frac{1}{2}$ Quotient $1\frac{2}{5}$.
Divide $\frac{1}{3}$ of 7 by $7\frac{1}{2}$. Quotient $\frac{14}{45}$.

RULE OF THREE DIRECT.

NOTE 1.—Make a stating, and, as in whole numbers, multiply the 2nd and 3rd terms together, and divide the product by the first term, the quotient will be a fraction of the same name as the middle term, and will generally require to be reduced.

Examples.

If $\frac{1}{4}$lb. cost $\frac{11}{12}$£. what cost $\frac{5}{16}$lb. ?
If $\frac{1}{4}$lb. : $\frac{11}{12}$£. : : $\frac{5}{16}$lb.
$\frac{11}{12} \times \frac{5}{16} = \frac{55}{192}$ which divided by $\frac{1}{4}$ is $\frac{55}{192} \times \frac{4}{1} = \frac{220}{192}$£. reduced is £1 2s. 11d. the Answer.
If $\frac{3}{5}$ ell cost $\frac{2}{3}$£. what cost $\frac{1}{17}$ ell ? Ans. 15s. $8\frac{4}{17}$d.
If $6\frac{1}{2}$ yds. cost 18s., what cost $9\frac{1}{4}$ yds. A. £1 5s. $7\frac{1}{4}$d. $\frac{7}{13}$f.

NOTE 2.—By the problems in Reduction reduce mixed numbers to Fractions and Compound Fractions to simple ones. Then proceed as by the last note.

Examples.

If $18\frac{1}{2}$ yds. cost £17 10s., what cost $6\frac{1}{6}$ yard ?
$18\frac{1}{2}$yds.$= \frac{37}{2}$ £17 10s. or $17\frac{1}{2}$ is $\frac{35}{2}$£. and $6\frac{1}{6}$yds$= \frac{37}{6}$yds
Then, $\frac{37}{2}$yd. : $\frac{35}{2}$£. : : $\frac{37}{6}$yd.
$\frac{35}{2} \times \frac{37}{6} = \frac{1295}{12}$ which divided by $\frac{37}{2} = \frac{1295}{12} \times \frac{2}{37} = \frac{2590}{444}$£. reduced by Prob. 3, is £5 16s. 8d.

If $1\frac{1}{4}$ yard cost 9s., what cost $16\frac{1}{4}$ yds.? *A.* £5 17s.
If $\frac{9}{10}$ C. cost £14 4s. what will $7\frac{1}{2}$ C. cost ?
A. £118 6s. 8d.
If $\frac{3}{5}$ of an ell cost $\frac{3}{8}$ of 19s. what cost 7 ells ?
A. £7 7s. $9\frac{1}{4}$d. $\frac{3}{9}$f.

RULE OF THREE INVERSE.

NOTE.—Having prepared the numbers, state the question as directed in page 27, then proceed as in the Rule of Three Direct.

Examples.

If 16 men finish a boat in $28\frac{1}{3}$ days, how many would 12 men require to do the same work? *A.* $37\frac{7}{9}$ days.

If $1\frac{1}{4}$ yard in breadth require $20\frac{1}{2}$ yards long for a cloak, what length will $\frac{3}{4}$ yard wide require to make the same? *A.* $34\frac{1}{6}$ yards.

How many pieces of money worth $20\frac{1}{8}$s. per piece, are worth $240\frac{1}{7}$ pieces at $12\frac{1}{2}$s. per piece? *A.* 25 pieces.

RULE OF FIVE.

OBSERVE.—*Work by the rule for whole numbers, page* 55.

Examples.

If 9 persons spend £$10\frac{7}{8}$ in 18 days, how much will 20 persons spend in 30 days? *A.* £40 5s. $6\frac{1}{2}$d. and $\frac{4}{9}$f.

Three men having worked $19\frac{1}{2}$ days received £$8\frac{9}{10}$, how much must 20 men have for $100\frac{1}{4}$ days?

A. £$305\frac{4}{11}$.

A man and his wife earn $4\frac{5}{8}$s. in one day, how much is earned in $10\frac{1}{2}$ days, when their two sons help them?

A. £4 17s. $1\frac{1}{2}$d.

DECIMAL FRACTIONS.

DECIMAL FRACTIONS have an unit understood for their denominator, with as many ciphers annexed as there are figures in the numerator; and are written with a point prefixed, as ·2, ·34, ·064, which are read thus; ·2, two-tenths; 34, thirty-four hundredth parts; 064, sixty-four thousandth parts.

NOTE.—Ciphers on the right hand of decimals do not alter their value, ·5 is the same as ·50; being respectively $\frac{5}{10}$, $\frac{50}{100} = \frac{1}{2}$.

ADDITION AND SUBTRACTION.

RULE.—In writing down the given numbers, place the decimal points directly under one another; then proceed as in whole numbers.

What is the sum of 2·64, 85·6, ·945, 14·8, 5·3456, and ·84?

What is the sum of ·78511, 84·35, 1·654, ·8956, ·009, and 10·161 ?

Subtract ·2475 from ·58975, and ·047 from 5.

What is the difference of 84·95 and 3·6954 ?

What is the difference of ·246 and ·8154 ?

MULTIPLICATION.

RULE.—Place the factors and multiply as in whole numbers. Point off as many decimal places in the product, from the right to the left, as there are decimals in both factors; and, if in the product, there are not so many figures as in both factors, write ciphers for what are wanting on the left hand of the product.

Mult. 346·549 by 3·15	Mult. 479·52 by .709.
Mult. 516·8954 by 64·89	Mult. ·007684 by ·765.
Mult. ·846153 by ·005	Mult. ·006003 by ·0089.

DIVISION.

RULE.—Divide as in whole numbers, and point off from the right of the quotient as many figures for decimals as the dividend has more than the divisor. When the divisor has more figures than the dividend, annex ciphers to the dividend; and, when there is a remainder, annex a cipher to it, and continue the division to at least five decimal places by annexing ciphers to remainders. Prove every example by Multiplication.

Divide 7·687846 by 6.5.	Divide ·7657 by ·2764.
Divide 157·874 by 67·848.	Divide ·578 by 1·678.

NOTE.—Remember, that the decimal places of the divisor and the quotient, taken together, are always to be equal in number to the decimals of the dividend. Therefore, when the number of decimals in the quotient, is less than the required number of decimals, put as many ciphers to the left of the quotient, as will make up the deficiency, taking care to put the decimal points in their proper places.

Divide 6·785 by 257.	Divide 4· by ·25.
Divide ·976 by 57·6.	Divide 75· by ·75.
Divide ·575 by 5750.	Divide 7·5 by ·75.
Divide 4· by 25.	Divide ·75 by 75.
Divide ·4 by ·25	

REDUCTION.

PROBLEM 1.—To reduce a vulgar fraction to a decimal.

RULE.—Annex to the numerator one cipher, or more, if necessary, for continuing the division; and divide by the denominator.

Examples.

What are the decimals for £$\frac{1}{4}$. £$\frac{1}{2}$. £$\frac{3}{4}$. £$\frac{1}{8}$. ?

Ans. £·25, £·5 £·75 and £·125.

What are the decimals for $\frac{7}{8}$, $\frac{5}{6}$ and $\frac{3}{16}$. ?

Ans. ·875, ·833, &c., and ·1875.

Reduce $\frac{1}{7}$, $\frac{5}{6}$, $\frac{6}{11}$ and $\frac{7}{16}$ to decimals.

PROBLEM 2.—To reduce a given quantity to the decimal of its Integer.

RULE 1.—When the quantity is of one denomination, divide it by as many of it as make one of the greater.

Examples.

Reduce 17 shillings and 9 pence to decimals of a pound.

20)17·0(·85 £240)9·00(·0375.

Facit £·85 £·0375.

Reduce 19 shillings to decimals of a pound. F. £·95.

Reduce 5 pence to decimals of a pound. F. £·020833.

Reduce 3 farthings to decimals of a pound. F. £·003125.

Reduce 27lbs. to decimals of a cwt. F. ·241071 cwt.

Reduce 7oz. to decimals of a lb. Troy. F. ·583333 lb.

RULE 2.—When the quantity is of several denominations, reduce the lowest to the next higher; to the quotient prefix the next left hand denomination and continue to divide.

Examples.

Reduce 16s. 9½d. to decimals of a pound.

4)1·0 f.

·25 d.

12)9·25 d.

·77083333s.

20)16·77083333s.

Facit ·83854166£.

NOTE.—The recurring decimal is called a single circulating decimal.

Reduce 12cwts. 2qrs. 21lbs. to decimals of a ton.

28)21·0lb.

·75qrs.

4)2·75

·6875cwt.

20)12·6875cwts.

Facit ·634375ton.

Reduce 14s. 3½d. to the decimal of a pound.
F. ·71458333, &c.

Reduce 3qrs. 12lb. 5·12oz. to decimals of a cwt. F. ·86.

Reduce 5 fur., 25 poles to decimals of a mile.
F. ·703125, &c.

Reduce 175 days to decimals of a year. F. ·479452.

PROBLEM 3.—To reduce decimals to their proper quantity.

RULE.—Multiply them by as many of the next denomination as make the integer of the decimal; point off the decimals in the product, and multiply them by as many of the next lower denomination, and proceed thus to the lowest denomination. The whole numbers shew the proper quantity or value. This problem proves the last.

What is the value of ·57 of a pound sterling?

·57
20
11·40 s.
12
4·80 a.
4
3·20 f.

Ans. 11s. 4d. 3·2 f.

Reduce ·86 of a cwt. to its proper quantity.

·86
4
3·44 qrs.
28
12·32 lbs.
16
5·12 oz.

Facit 3qrs. 12lbs. 5·12 oz.

What is the value of ·461 of a shilling? A. 5d. 2·128f.

What is the value of ·6845 cwt? A. 2qrs. 20lb. 10·624oz.

What is the value of £·1875? A. 3s. 9d.

What is the value of ·761 of a hhd. of Wine?
A. 47gal. 3qts. 1·544pt.

RULE OF THREE.

When requisite, reduce the terms to decimals. In multiplying and dividing take care to point off properly, and reduce the final decimals to their proper quantity.

Examples.

If 1·4 gallons cost 14·5s., what cost 75·31 gall. ?
Ans. £38 19s. 11d. 3·52f.

What cost 1·7lb. of Tobacco if 1·47cwt. cost £4·5 ?
Ans. 11·1504d., &c.

Bought a Silver Cup for £15 12s. at 5s. 3d. per oz. what was the weight ? Ans. 59·428571 oz.

What cost 3·5lbs. of Tea, if a chest containing 31·5lbs. cost £25 17s. 6d. ? Ans. £2·875, or £2 17s. 6d.

COMPOUND INTEREST.

The following Table shews the Amount of £1 at 5 per cent. Compound Interest, for any number of years not exceeding fifteen :—

Yrs.	*Amounts.*	*Yrs.*	*Amounts.*	*Yrs.*	*Amounts.*
1	1·05	6	1·340095	11	1·710339
2	1·1025	7	1·407100	12	1·795856
3	1·157625	8	1·477455	13	1·885649
4	1·215506	9	1·551328	14	1·979931
5	1·276281	10	1·628894	15	2·078928

PROBLEM.—To find the Amount of any sum for a given number of years not exceeding fifteen.

RULE.—Multiply the number in the Table, opposite to the given years, by the given sum, and the product will be the Amount required.

Examples.

What are the separate Amounts of £50 for 14 years, and 15 years, at 5 per cent. per annum, Compound Interest ? *A.* £98 19s. 11·172d., and £103 18s. 11·136d.

What is the Amount of £50 10s. for 15 years, at 5 per cent. per annum Compound Interest ?
A. £104 19s. 8·60736d.

A TABLE

Shewing the Value of Annuities upon one Life at 5 per Cent.

AGES.	YRS. VALUE.	AGES.	YRS. VALUE.	AGES.	YRS. VALUE.
51	9·42	61	7·89	71	6·19
52	9·31	62	7·68	72	6·05
53	9·19	63	7·53	73	5·89
54	9·09	64	7·35	74	5·80
55	8·89	65	7·14	75	5·60
56	8·72	66	6·96	76	5·44
57	8·59	67	6·79	77	5·18
58	8·41	68	6·65	78	4·86
59	8·22	69	6·48	79	4·56
60	8·00	70	6·38	80	4·26

PROBLEM.—To find what annuity may be purchased for a given sum, for any age from 51 to 80 inclusive. Or, to find the value of an annuity for any age from 51 to 80.

RULE.—In the first case, divide the given sum by the number opposite to the given age, and the quotient will be the annuity required. In the other case, multiply the annuity by the number opposite the given age, and the product will be the value required.

Examples.

My brother, going to India, leaves £500 for the purchase of an annuity or yearly income, for our grandfather aged 80; what will be the annuity? *A.* £117 7s. 5d.

A gentleman wants to purchase an annuity of £100 for his wife, aged 57 years; how much must he pay for it? *A.* £859.

DUODECIMALS OR CROSS MULTIPLICATION

Is a Rule by which artificers and workmen find the content of their work.

RULE 1.—Write the multiplier under the multiplicand, feet under feet, inches under inches, seconds under seconds.

2.—Multiply each denomination by the feet, divide every product by 12, place any remainder under the denomination from which it arises, and carry the quotient to the next product.

3.—Multiply by the inches, divide the product by 12, and when there is any remainder set it one place farther to the right hand, and proceed in like manner with seconds &c. Add the products together for the total.

TABLE.

Feet multiplied by feet give feet.
Inches multiplied by feet give primes.
Seconds multiplied by feet give seconds.
Inches multiplied by inches give seconds.
Seconds multiplied by inches give thirds.
Seconds multiplied by seconds give fourths.

Examples.

Multiply 7ft. 9in. 3″ by 4ft. 7in. 6″

	ft.	*in.*	″		
	7	9	3		
	4	7	6		
	31	1	0		
	4	6	4	9‴	
		3	10	7	6⁗
Product	35	11′	3″	4‴	6⁗

Multiply 4 ft. 5 in. by 3 ft. 6 in. F. 15 ft. 5′ 6″.
Multiply 6 ft. 6 in. by 3 ft. 8 in.
Multiply 17 ft. 1 in. by 7 ft. 2 in. F. 122 ft. 5′ 2″.
Multiply 12 ft. 3 in. by 3 ft. 4 in.
Multiply 7 ft. 1 in. 9″ by 7 ft. 8 in.
F. 54 ft. 9 in. 5″.
Multiply 3 ft. 8 in. 4″ by 3 ft. 9 in. 2″.
Multiply 9 ft. 8 in. 7″ by 12 ft. 3 in. 10″.
F. 119 ft. 8 in. 2″ 10‴ 10‴.
Multiply 9 ft. 8 in. 7″ by 6 ft. 5 in. 4″.
Multiply 3 ft. 2 in. 1″ by 2 ft. 3 in. 4″.
F. 7 ft. 2 in. 8″ 11‴ 4⁗.
Multiply 5 ft. 6 in. 7″ by 8 ft. 9 in. 10″.

Rule 2.—When the feet in each factor exceed 12, multiply them together, and for the inches, &c. in the multiplier take parts of the multiplicand; but for the inches, &c. in the multiplicand take parts only of the feet of the multiplier.

Multiply 43ft. 10in. by 39 ft. 1in.

		ft.	*in.*	
1 =	1/12	43	10	
6 =	1/2	39	1	
4 =	1/3	387	0	
		129		
		3	7	10 for 1 in.
		19	6	0 for 1/2 of 39.
		13	0	0 for 1/3 of 39.
Total,		1713	1	10

Multiply 48ft. 7in. by 36ft. 6in. F.

Multiply 56ft. 1in. 4″ by 48ft. 3in. 6″.

PROBLEM.—To find the content of a plank or any parallel sided superficies, of a given length and breadth; or of a parallel sided piece of timber, of a given length, breadth, and thickness.

RULE.—Multiply the length by the breadth, for the plank, &c. and for the piece of timber, multiply the length, breadth, and thickness together.

Examples.

What is the content of 3 planks, each 9ft. 8in. long, and 4ft. 5in. broad? *A.* 128ft. 1′.

What is the content of a piece of timber 3ft. 6in. long, 2ft. 4in. in breadth, and 1ft. 5in. thick, and what is the value at 1s. 6d. per solid foot.

A. The content is 11ft. 6′ 10″ value 17s. 4¼d.

What is the content of a glass window 7ft 3in. high, and 3ft 5in. broad? *A.* 24ft. 9′ 3″.

What will be the cost of glazing a window 6ft. 3in. high, and 3ft. 6in. broad, at 1s. 6d. per foot?

A. £1 12s. 9¾d.

My court yard is 24ft. 8in. long, and 12ft. 3in. broad, what will be the cost of paving at 3s. 4d. per square yard? A. £5 11s. 10¾d. and $\frac{23}{27}$f.

POSITION.

By this rule, by means of supposed numbers, a true one is discovered. Position is either Single or Double.

SINGLE POSITION

Is when a single supposition is made.

RULE.—Suppose any number to be the number sought, and work with it as the question directs. If the result be the same as that in the question, the supposed number is the true one; if not, say, as the result of the operation : is to the supposed number, : : so is the result in the question : to the number required.

Examples.

What number is that which being increased by $\frac{1}{4}$ and $\frac{1}{5}$ of itself, the sum shall be 87 ?

Suppose	20
$\frac{1}{4}$ is	5
$\frac{1}{5}$ is	4
Result	29

As 29 : 20 : : 87 : 60 the true number.

20

29)1740(60

A person being asked, how many crowns he had, said if the $\frac{1}{3}$, $\frac{1}{4}$, and $\frac{1}{6}$ be added together, the sum will be 108. How many had he ? *A.* 144.

What number is that, to which if you add $\frac{1}{4}$ part of itself, the sum will be 70 ? *A.* 56.

A captain after sending on shore $\frac{1}{2}$ and $\frac{1}{6}$ of his men, had 50 left. What was the number of the ship's crew ? *A.* 150.

What is the sum, which with Interest for 10 years at 6 per cent., amounts to £500 ? *A.* £312 10s.

DOUBLE POSITION.

DOUBLE POSITION discovers the true number sought by means of two supposed numbers.

RULE.—Suppose a number as in Single Position, work with it as the question directs. If the result agrees with the given result, the supposed number is the true one; if not, suppose another number and work in the same manner; then, if this supposition also does not agree, find the difference between each result and the given number. Call the two differences errors. Multiply each error by the other's position. If the errors are both alike, that is too much or too little, take their difference for a divisor, and the difference of the products for a dividend; but if the errors are unlike, that is one too much and the other too little, call their sum a divisor and the sum of their products a dividend; the quotient will be the number sought.

Examples.

A, B, and C divide £100 among them; B. is to have £10 more than A, and C as much as A and B together.

Suppose A's	=	10	Suppose A's	=	50
then B's	=	20	then B's	=	60
and C's	=	30	and C's	=	110
Result		60	Result		220
		100			100
Too little		40	Too much		120
10 × 120	=	1200	A 20		
50 × 40	=	2000	B 30		
Divisor 160		)3200(20	C 50		
		32	Proof 100		

A farmer received for a number of hogs, pigs, and sows, in all £50; for each hog 18s.; for each sow 16s. and pig 2s. There were as many hogs as sows, and for every sow three pigs. How many were there of each sort? *A.* 25h. 25s. 75p.

A man left a sum of money to three sons. To A the half of it, wanting £50, to B one-third, and to C the rest, which was £10 less than the share of B. What was the sum left and each son's part? *A.* Sum left was £360., A had £130, B had £120, C £110.

SOLUTION.

Suppose 120		Suppose 180	
Then A's=	10	A's=	40
B's=	40	B's=	60
	50		100
And C's=	70	C's=	80
But B's=	40	B's=	60
	30 more		20 more
Should be	10 less	Should be	10 less
Error	40 too much	Error	30 too much

$40 \times 180 = 7200$
$30 \times 120 = 3600$

Difference 10 — 10)3600 Difference of the products

360 = Sum left

Whence A's £130, B's £120, and C's £110.

INVOLUTION

Teaches how to produce the powers of numbers. Powers of numbers are products produced by the continual multiplication of the number by itself. The number itself is called the root or first power; when multiplied by itself the product is the second power; again by itself the product is the third power.

Thus 2 is the first power of 2.

2×2 or $2^2 = 4$ is the second power or square.

$2 \times 2 \times 2$ or $2^3 = 8$ is the third power or cube.

$\frac{2}{3} \times \frac{2}{3} \times \frac{2}{3}$ or $\overline{\frac{2}{3}}\Big|^3 = \frac{8}{27}$ do. or cube of $\frac{2}{3}$.

The small figures are indices which shew how often the number is written for multiplication.

Examples.

What is the cube or 3rd power of 54? *A.* 157464.

What is the 5th power of 12·6? *A.*

What is the 4th power of $\frac{5}{6}$? *A.* $\frac{625}{6561}$.

TABLE OF POWERS.

1st Power or Roots.	1	2	3	4	5	6	7	8	9
2nd, or Square	1	4	9	16	25	36	49	64	81
3rd, or Cube	1	8	27	64	125	216	343	512	729
4th	1	16	81	256	625	1296	2401	4096	6561
5th	1	32	243	1024	3125	7776	16807	32768	59049
6th	1	64	729	4096	15625	46656	117649	262144	531441
7th	1	128	2187	16384	78125	279936	823543	2097152	4782969
8th	1	256	6561	65536	390625	1679616	5764801	16777216	43046721
9th	1	512	19683	262144	1953125	10077696	40353607	134217728	387420489

NOTE.—1, 2, 3, 4, 5, 6, 7, 8, and 9 are Indices. Example $2^9 = 512$.

PROBLEM.—To find any distant powers of the roots in the Table without producing all the intermediate powers.

RULE.—Take from the Table indices of which the sum is equal to the index of the required power. Then the continual multiplication of the powers belonging to such indices, will give the required power.

Examples.

What is the 15th power of 3 ?

Indices $7 + 8 = 15$ the index of the required power.

Then $3^7 \times 3^8$ or $2187 \times 6561 = 14348907$ the 15th power of 3.

What is the 12th power of 4 ? *A.* 16777216.

What is the 30th power of 2 ? *A.*

EVOLUTION

Teaches how to find some root of a given number or power. When the given number is in the Table the root stands over it. Thus the cube root of 789 is 9.

TO EXTRACT THE SQUARE ROOT.

RULE.—Put a dot over the units, and if the number consists of more than two figures, put a dot over the third from the units, and thus divide any whole number into periods by pointing from right to left; but in decimals point from left to right. Thus $\dot{2}7\dot{6}1\dot{5}$, $0\dot{1}2\dot{7}$.

Having found the greatest square, subtract it from the given number; and, having put the root to the right, to the remainder bring down the next period for a dividend. On the left of the dividend write the double of the root found for a divisor. Ask how often this double is contained in the dividend, rejecting its last figure, and place the answer after the root found and after the divisor. Multiply the new divisor by the last figure of the root, and subtract the product from the dividend. If the product is too much, put a less figure to the root, and after the divisor. To the remainder annex the next period for a new dividend, and find a new divisor by doubling the whole root and thus continue the work.

Examples.

Extract the square root of $\dot{2}\cdot\dot{0}0\dot{0}0$ (1·4142 + root.

1

24 | 100 Dividend
96

281 | 400
281

2824 | 11900
11296

28282 | 60400
56564

3836

Extract the square root of $\dot{7}6\dot{1}8\dot{4}\cdot\dot{3}7\dot{6}\dot{0}$ (276·0158.

4

47 | 361 Dividend
329

546 | 3284
3276

55201 | 83760
55201

552025 | 2855900
2760125

95775

Proof.—Multiply the root by itself, and to the product add the remainder.

What is the square root of 5 ? *A.* 2·236068.

What is the square root of 3·1721812 ? *A.* 1·78106 &c.

What is the square root of 761·801216 ? *A.* 27·6007 &c.

What is the square root of ·0007612816 ? *A.* ·02759 &c.

Problem.—To extract the square root of a vulgar fraction.

Rule.—If the numerator and denominator are square numbers, the root of each will be the terms of the fraction required. Thus the square root of $\frac{16}{25}$ is $\frac{4}{5}$. But if the terms of the given fraction are not squares, reduce it to a decimal by Prob. 1, page 69, and extract the root as already directed.

Note.—The Vulgar Fractions of mixt numbers must be reduced to decimals.

What is the square root

of $\frac{5}{12}$? *A.* 0·645469, &c. | of $\frac{387}{729}$? *A.* 0·72414, &c.

of $7\frac{9}{11}$? *A.* 2·7961, &c. | of $76\frac{14}{17}$? *A.* 8·7649, &c.

TO EXTRACT THE CUBE ROOT.

Rule.—Put a point over the unit's place and over every third figure to the left; but in decimals over every

third to the right. Thus 61$\dot{2}$18·00$\dot{1}$210. Then find by the table the nearest less or an equal cube number to the left hand period, and put its root for the first figure of the root sought. 2.—Subtract this cube from the first period, and to the remainder bring down the next period for a dividend. 3.—Find a divisor by multiplying the square of the root by 300. 4.—Divide the dividend by this divisor and the quotient is the next figure of the root. 5.—Multiply the figure (or figures) of the root found by 30, and the product by the last figure, and write the product under the divisor. 6.—Under this last product, write the square of the last figure of the root found, and add the three numbers together. 7.—Multiply the sum of these three numbers by the last figure of the root, and subtract the product from the dividend; but if the product is greater than the dividend, put a less figure than the last to the root, and alter the work. 8.—To the remainder bring down the next period for a new dividend, with which proceed as with the first dividend, until all the periods are brought down. Prove the work by cubing the root and adding the remainder.

What is the cube root of 61218·00121 ?

$$
\begin{array}{rl}
 & 61\dot{2}18\cdot00\dot{1}21\,(39\cdot41 \\
 & 3^3 = 27 \\
3^2 \times 300 = 2700 & \overline{34}218 \quad \text{1st Dividend} \\
3 \times 30 \times 9 = 810 & \\
9^2 = 81 & \\
\hline
9 \times 3591 = 32319 & \\
\hline
\text{2nd Divisor } 39^2 \times 300 = 456300 & \mid 1899001 \quad \text{2nd D.} \\
39 \times 30 \times 9 = 4680 & \\
4^2 = 16 & \\
\hline
4 \times 460996 = 1843984 & \\
\hline
\text{3rd Divisor } 394^2 \times 300 = 46570800 & \mid 55017210 \quad \text{3rd D.} \\
394 \times 30 \times 1 = 11820 & \\
1^2 = 1 & \\
\hline
1 \times 46582621 = 46582621 & \\
\hline
8434589 \text{ Remainder.} &
\end{array}
$$

What is the cube root of 7612·81861 ? *A.* 19·67, &c.
What is the cube root of 7612181·7612 ? *A.* 196·71, &c.

ARITHMETICAL PROGRESSION.

When a series of numbers increases by equal differences, they are said to be in Arithmetical Progression.

As 1, 4, 7, 10, 13 common difference is 3.
As $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{4}$ common difference is $\frac{1}{4}$.

NOTE.—*The last term and the sum of all the terms may be found by addition, thus, of the series* 1, 3, 5, 7, *&c., to nine terms, the last term found by continual addition is* 17, *and the sum of all the terms is* 81. *But as this method, for a long series, would be tedious, the following two rules were invented to shorten such operations.*

PROBLEM 1.—Given the first term, the number of terms and the common difference, to find the last term.

RULE.—Multiply the common difference, by a number which is one less than the number of terms; add the product to the first term, and the sum will be the last.

Examples.

Given the first term 3, the common difference 2, and the number of terms 9, to find the last term. Facit 19.

A man bought 100 yards of cloth, the first yard cost 10 pence, the second 13 pence, increasing 3 pence every yard; what was the price of the last yard ? *A.* £1 5s. 7d.

John is indebted to James, and agrees to pay off the debt in one year, by paying 5 shillings the first week, 9 shillings the second, increasing the payment every following week by 4 shillings; what is the debt ?

A. £10 9s.

PROBLEM 2.—Given the first term, the number of terms and the common difference to find the sum of all the terms.

RULE.—Find the last term by the last rule. Multiply the sum of the first and last by the number of terms, and half the product will be the sum of all the terms.

Examples.

Bought 19 yards of shalloon, and gave 1d. for the first yard, 3d. for the second, and 5d. for the third, in-

creasing 2d. every yard; what did I give for the 19 yards? *A.* £1 10s. 1d.

Sold 100 yards of cloth, viz. the first yard for 10d., the second for 13d., and the third for 16d.; for how much was the said cloth sold? *A.* £61 0s. 10d.

GEOMETRICAL PROGRESSION.

A series of numbers, which increases by one common multiplier or ratio, is called a Geometrical Progression.

Thus, of the series 2, 4, 8, 16, 32 the ratio is 2.
of the series ¼, 1, 4, 16, 64 the ratio is 4.

NOTE.—*The last term of a Geometrical Progression may be found by continual multiplication, and the sum of all the terms by addition. But as such operations would be long and tedious, and, in some cases almost impossible, the Rules to the two following Problems have been invented to shorten the work.*

PROBLEM 1.—Given the first term, the ratio, and the number of terms of a geometrical series to find the last term.

RULE.—Raise the ratio to the power, whose index is one less than the number of terms. Multiply this power by the first term, and the product will be the last term.

Examples.

Given the first term 3, the ratio 3, and the number of terms 12 of a geometrical series, what is the last term? *A.* 531541.

The ratio 3, is to be raised to the 11th power.

By the table of powers, and Rule page 79,

3^9	is	19683
3^2	is	9
Hence 3^{11}	=	177147
First term		3
Last term		531441

A tailor sold to a simpleton a silk waistcoat, which had thirteen buttons, at one farthing the first button, two for the second, four for the third, doubling the price of

each succeeding button. He was to have for the waistcoat the price of the last button, what did the simpleton pay?
A. £4 5s. 4d.

PROBLEM 2.—Given the first term, the ratio, and the number of terms, to find the sum of all the terms.

RULE.—Find the last term by the last rule, and divide the difference of the first and last by the ratio less 1. To the quotient add the last term and you will have the sum of all the terms.

Examples.

Given the first term 2, the ratio 4, and the number of terms 9, what is the sum of the series? *A.* 174762.

The ratio 4, is to be raised to the 8th power.

By the table 4^8 is	65536	Ratio 4 less 1 =	3
First term	2		3)131070
Last term	131072	Quotient	43690
First term	2		131072
Difference	131070	Sum of the series	174762

What debt will be discharged in 14 months by paying £1 the first month, £2 the second, £4 the third, and so on, each succeeding payment being double the last?
A. £16383.

A lady offered ten guineas for a set of china consisting of 20 pieces, the seller said the offer was too low; but if she would give only one pin for the first piece, three for the second, nine for the third, tripling for each succeeding piece, she might have the china. What would be the cost at this rate, if twenty of the pins were sold for a farthing? *A.* £90801 13s. 6½d.

Miscellaneous Examples.

1. The sum of two numbers is 19001, the less is 409, what is the greater?
2. The difference between two numbers is 1096, the greater is 6784, what is the less?
3. What is the product of 7029 by itself?
4. The divisor is 7029, the dividend is 49406841, what is the quotient? *A.*

5. The product of two numbers is 5742, one of them is 234, what is the other? *A.* 24, rem. $\frac{7}{13}$.

6. The quotient of a division is 72, the remainder is 13, the divisor 23; what is the dividend?

7. In what time will a man count one million of sovereigns, at the rate of 80 in a minute? *A.* 8 days, 16 hours, 20 minutes.

8. A has £784 in cash, he owes to B £45 11s., to C £73 15s. 6d., and to D £476 11s. 7½d., when all are paid what will be left?

9. In 50 sovereigns, as many crowns, shillings, and pence, how many farthings? *A.* 62600.

10. In 4 cwts. 3 qrs. 21 lbs. of tea, how many canisters, each 7 lbs.? *A.* 79.

11. How many spoons can I make out of 60 lbs. of silver, each spoon to weigh 3 oz. 15 dwts.? *A.* 192.

12. In 1200 gallons of wine, how many casks, each 6 gallons 2 quarts? *A.* 184 casks, 4 gals.

13. How many small gardens can there be laid out in 6 square acres of land, each garden to contain 625 square yards? *A.* 46 gardens, 290 square yards.

14. In eighteen years, how many minutes? *A.* 9467280.

15. What must I pay for the carriage of 14 tons 8 cwts., at the rate of £1 13s. 6d. per cwt.? *A.* £469.

16. If 5 cwts. 0 qrs. 4 lbs. are carried 77 miles, how far ought 35 cwts. 1 qr. to be carried for the same money? *A.* 11 miles.

17. If six persons are allowed two dozens of wine for a fortnight, how long would the same quantity last, if another person were added to the company? *A.* 12 days.

18. X, Y, and Z freighted a ship with 108 tuns of wine; of which X had 48, Y 36, Z 24. If 45 tuns are thrown into the sea, how much must each sustain of the loss? *A.* X 20, Y 15, and Z 10.

19. P delivered 189 gallons of rum at 6s. 8d. per gallon, for 126 yards of cloth; what was the cloth a yard? *A.* 10s.

20. X had 41 cwts. of soap at £1 10s. per cwt., for which Y gave £20 in money, and the rest in sugar at 5d. per lb., how much sugar did Y deliver to X.? *A.* 17 cwts. 3 qrs. 4 lbs.

21. D bought lace at 4s. per yard, and sold it at 4s. 9d., what was the gain per cent.? *A.* £18 15s.

22. E sold 500 caps at 1s. 3d. each, and lost £12 per cent., what did he lose on the whole? *A.* £3 15s.

23. A ship worth £8400, being lost at sea, of which $\frac{1}{4}$ belonged to A, $\frac{1}{3}$ to B, and the remainder to C; what loss will each sustain, supposing they have £6000 insured? *A.* A's loss £600, B's £800, and C's £1000.

24. A and B have gained 1260 dollars, whereof A is to have ten per cent. more than B, what is the share of each?

A. A's 660, and B's 600 dollars.

25. A maltster mingles 30 quarters of malt, at 28s. per quarter, with 46 quarters at 30s. per quarter, and 24 quarters at 25s. per quarter; what is the value of 8 bushels of this mixture? *A.* £1 8s. 2¼d. and $\frac{2}{5}$f.

26. Divide 15 into two such parts, so that when the greater is multiplied by 4, and the less by 16, the products will be equal.

27. How many yards of silk, 3 qrs. wide, will line a cloak, which has 12 yds. of velvet, 2 qrs. wide? *A.* 8 yards.

28. Find by the Rule of Practice the value of 173 cwts. 1 qr. 14 lbs. at £3 15s. 6d. per cwt. Facit. £654 9s. 9¼d.

29. Find by Practice the value of 58361 tons at £48 12s. 9d. per ton. Facit. £2838533 2s. 9d.

30. Add $9\frac{1}{14}$, $7\frac{9}{14}$, $5\frac{5}{14}$, & $8\frac{11}{14}$ together. Facit. $31\frac{5}{7}$.

31. Add $5\frac{3}{5}$, $6\frac{7}{8}$, and $4\frac{1}{2}$ together. Facit. $17\frac{1}{24}$.

32. From 19 take $\frac{1}{10}$ and from 100 take $99\frac{99}{100}$.

33. Which of these two is the greater fraction, $\frac{11}{12}$ or $\frac{15}{16}$?

34. From 7 weeks take $9\frac{7}{10}$ days. Facit. 5w. 4d. 7h. 12 min.

35. Multiply $4\frac{1}{2}$ by $\frac{1}{8}$, and $48\frac{3}{5}$ by $13\frac{1}{8}$. Facits. $\frac{9}{16}$ and $672\frac{1}{5}$.

36. Divide $3\frac{1}{6}$ by $9\frac{1}{2}$, and $9\frac{1}{6}$ by $\frac{1}{2}$ of 7. Facits. $\frac{1}{3}$ and $2\frac{13}{21}$.

37. Of what number is 176 the $\frac{11}{23}$ part? *A.* 368.

38. A has $\frac{3}{5}$ of $\frac{1}{4}$ of a ship, and B has $\frac{3}{8}$ of $\frac{4}{5}$, which has the greater share, and by how much? *A.* A's is greater by $\frac{1}{5}$.

39. If $\frac{3}{10}$ of a ship cost £273 2s. 6d., what are $\frac{5}{32}$ of her worth? *A.* £227 12s. 1d.

40. If $\frac{1}{4}$ of a yard cost $\frac{2}{3}$ of a pound, what will $\frac{3}{5}$ of an ell English come to at the same rate? *A.* £2.

41. If the penny white loaf weigh 7 oz. when a bushel of wheat cost 5s. 6d., what is the bushel worth when the penny white loaf weighs but $2\frac{1}{2}$ oz.? *A.* 15s. $4\frac{4}{5}$d.

42. Subtract 1·75 from 18 and five hundredths.

43. Multiply sixty-five and seven-tenths, by three and six hundredths.

44. If 14 oz. 11 dwts. 16 grs. Troy are equal to 1 lb. Avoirdupois, how much Avoirdupois is equal to 20 lbs. Troy, the weight of $934\frac{1}{2}$ sovereigns. *A.* $16\frac{16}{35}$ lbs. Avoirdupois.

45. In 1819, the national debt was £800,000,000. If this amount were in sovereigns, and supposing $934\frac{1}{2}$ to weigh $16\frac{16}{35}$ lbs. Avoirdupois, what would be the weight of the whole debt?

A. 6289 $\frac{15697}{30527}$ tons.

46. What is the amount of £480 for 6 years, at 5 per cent. per annum, Compound Interest? *A.* £643 4s. $10\frac{1}{4}$d. 976.

47. What is the present worth of £161 10s., for 19 months, at 5 per cent.? *A.* £149 13s. $0\frac{1}{2}$d.

48. My uncle aged 65 years, wants to buy an annuity for his life for £1050, what will be the annuity? *A.* £147 1s. 2·1168d.

49. How many roubles at Petersburgh for £3000 sterling, exchange at $31\frac{1}{4}$d. sterling per rouble? *A.* 22677 rou. 16 cap. rem. 68.

50. What is the value of a marble slab, whose length is 5 feet 7 inches, and breadth 1 ft. 10 in., at 4s. 6d. per foot? *A.* £2 6s. $0\frac{3}{4}$d.

51. If 100 eggs were placed in a right line, exactly a yard asunder from one another, and the first a yard from a basket, what length of ground does that man go, who gathers up these 100 eggs singly, returning with every egg to put it into the basket. *A.* 5 miles, 1300 yards.

52. A servant agreed with a gentleman to serve him 12 months, provided he would give him a farthing for his first month's service, a penny for the second, and 4d. for the third, &c., what did his wages amount to? *A.* £5825 8s. $5\frac{1}{4}$d.

53. What is the square root of 22071204? *A.* 4668.

54. There is a cellar dug that is 12 feet every way, in length, breadth, and depth, how many solid feet of earth were taken out of it? *A.* 1728.

55. What is the cube root of 84604519. *A.* 439.

APPENDIX.

Short methods of reckoning for exercises in mental calculation, the quantities not exceeding 400.

RULE.—Consider the price as yards, &c. and the number of yards, &c. as the price.

yds.	*d.*		*yds.*	*d.*		*s.*	*d.*		*£.*	*s.*	*d.*
39 at	3	=	3	at 39	or at	3	3.	F.	0	9	9
57 at	4	=	4	at 57	or at	4	9.	F.	0	19	0
96 at	7½	=	7½	at 96	or at	8	0.	F.	3	0	0
42½ at	9½	=	9½	at 42½	or at	3	6½.	F.	1	13	7½
15¼ at	10	=	10	at 15¼	or at	1	3¾.	F.	0	13	1½
37 at	7½	=	7½	at 37	or at	3	1.	F.	1	3	1
144 at	9¼	=	9¼	at 144	or at	12	0.	F.	5	11	0
200 at	10½	=	10½	at 200	or at	16	8.	F.	8	17	0
240 at	11¼	=	11¼	at 240	or at	20	0.	F.	11	15	0
289 at	3½	=	3½	at 289	or at	24	1.	F.	4	4	3½
300 at	11¼	=	11¼	at 300	or at	25	0.	F.	14	13	9

	d.			*d.*		*£.*	*s.*	*d.*				
365 at	4	=	4	at 365	or at	1	10	5.	F.	6	1	8
365 at	7	=	7	at 365	or at	1	10	5.	F.	10	12	11

For odd Shillings.

	s.			*s.*		*£*	*s.*	*d.*		*£.*	*s.*	*d.*
45 at	3	=	3	at 45	or at	2	5	0.	F.	6	15	0
168 at	7	=	7	at 168	or at	8	8	0.	F.	58	16	0
240 at	13	=	13	at 240	or at	12	0	0.	F.	156	0	0
299 at	11	=	11	at 299	or at	14	19	0.	F.	164	9	0
300 at	17	=	17	at 300	or at	15	0	0.	F.	255	0	0

For an even number of Shillings see Rule 7, Page 43, Practice.

Shillings and Pence.

ells.	*s.*	*d.*			*s.*		*£.*	*s.*	*d.*		*£.*	*s.*	*d.*
24 at	1	6	=	1½	at 24	or at	1	4	0.	F.	1	16	0
34 at	2	9	=	2¾	at 34	or at	1	14	0.	F.	4	13	6
136 at	7	3	=	7¼	at 136	or at	6	16	0.	F.	49	6	0
240 at	11	9	=	11¾	at 240	or at	12	0	0.	F.	141	0	0
15½ at	3	9	=	3¾	at	15	6.			F.	2	18	1½
17¼ at	5	6	=	5½	at	17	3.			F.	4	14	10½
19¼ at	12	3	=	12¼	at	19	9.			F.	12	1	11¼

When the Pence are not 3d., 6d., or 9d.

Examples.

48 yds at 1s. 11d.	60 at 3s. 8d.	108 at 11s. 11½d.
48 at 1s. £2 8s. 0d.	60 at 3s. £9 0s. 0d.	11 at £5 8s. £59 8s 0d
11 at 48d. £2 4s. 0d.	8 at 60d. £2 0s. 0d.	11 at 108d £4 19s 0d
£4 12s. 0d	£11 0s. 0d.	108 at ½d. 4s 6d
		£64 11s 6d

Examples for Exercises.

28 lbs. at 7½. F.	108 lbs. at 11½. F.	96 yds. at 5½. F.
50 lbs. at 8½. F.	31 yds. at 9¾. F.	120 yds. at 9½. F.

		s.	d.				s.	d.	
35 yds.	at	7	0.	F.	69 lbs.	at	16	10.	F.
40 „	at	9	6.	F.	48 „	at	4	3.	F.
220 „	at	11	6.	F.	96 „	at	5	9.	F.
24 „	at	4	2½.	F.	56 „	at	9	3.	F.
51 „	at	8	4.	F.	45 „	at	9	5.	F.
36 „	at	7	7.	F.	71 „	at	11	11½.	F.

EXAMPLES IN INTEREST.

RULE.—At 5 per Cent. the interest is 1d. per pound per month. Whence, the product of any sum by the months is the interest in pence. Accuracy requires odd shillings to be reduced to decimals. Observe, 5s. are considered = ½d., 10s. = ½d., 15s. = ¾d.

Examples.

The interest of £575 for 8 months is 575 × 8 = 4600 pence, or £2 7s. 11d. × 8 = £19 3s. 4d.; and the interest of £200 15s. is 200¾d. × 8 = 1606·00 pence, or 16s. 8¾d. × 8 = £6 13s. 10d.

What is the interest of £75 10s. for 7 months? F.
What is the interest of £46 15s. for 11 months? F.

For 6 per Cent.

RULE.—Multiply the Principal by the time in months, and the product by ·1, and the last product will be the interest in shillings. Odd shillings should be reduced to decimals of a pound.

Examples.

The interest of £50 for 6 months is 50 × 6 × ·1 = 30·0s. or £1 10s.

What is the interest of

£70 10s. for 9 months?	£150 for 11 months? F.
70·5 × 9 × ·1 = 63·45s. =	£250 for 18 months? F.
£3 3s. 5½d. ·6.	£350 for 9 months? F.

Having found by these short methods the interest of any sum at 5 or 6 per Cent.; interest at other rates may easily be had by aliquot parts.

Multiplication, Practice, and Vulgar Fractions afford to the ingenious Arithmetician, many methods of abridging operations. A little previous attentive inspection of numbers may often prevent much labour, as in this Example.

Mult. 67586184
By 48144968

540689472	=	8 times
3244136832	= 48000000	or 8 × 6.
6488273664	= 960	or 48 × 2.
9732410496	= 144000	or 48 × 3.
3253934665922112	= 48144968	times.

Suppose it were required to find the value of 8640 cwts. at £8 19s. 11¼d. $\frac{1}{7}$ per cwt.

	£	s.	d.
Value at £9 is	77760	0	0
Subtract	7	14	$3\frac{1}{4}\frac{5}{7}$
Value of 8640 cwts.	77752	5	$8\frac{1}{4}\frac{2}{7}$

To find this deduction.

	£	s.	d.
From	9	0	0
Take	8	19	$11\frac{1}{4}\frac{1}{7}$
Difference			$\frac{6}{7}$ farthing.

Then the product of $\frac{6}{7}$ f. by 8640 or $\frac{6}{7}$ of 8640 farthings is to be subtracted. But 8640 farthings = £9, and $\frac{6}{7}$ of £9 = $\frac{5}{7}\frac{4}{}$ = £7 14s. 3¼d. $\frac{5}{7}$f. which may be done mentally.

RECEIPTS.

Received *April* 8, 1835, of Mr. John Owen, ten pounds for half a year's rent, due March 31, 1835.

£10 0s. JOHN E. WALKER.

Received *June* 16, 1835, of Mr. Joseph Steele, twenty-five pounds, for half-a-year's interest on one thousand pounds, due the 13th instant.

£25. J. E. WADE.

PROMISSORY NOTES.

On demand I promise to pay to Mr. William Glover, or order, the sum of fifty pounds, for value received this day, *August* 3, 1835.

£50. ALFRED COOKMAN.

Hull, March 3*rd*, 1835.

Six months after date, I promise to pay to Mr. Edward Walker, or order, the sum of one hundred pounds for value received.

£100. FOSTER BEAN.

Mr. James Wilson, in Account with John Simpson.

1835.		£.	s.
Jan. 6.	To 10 Reams Post Paper at	1	1
Mar. 9.	„ 4 Ditto Foolscap at...	0	15
June 16.	„ 12 Ditto Blotting at ...	1	4
July 13.	„ 5 Hundred Quills at	0	3
Aug. 5.	„ 10 Doz. Copy Books at	0	4
„ 8.	„ 15 Reams Cartridge at	0	18
Sep. 14.	„ 5 Ledgers at.....	0	12
Oct. 18.	„ 8½ Doz. Slates at.....	0	9
Nov. 19.	„ 25 Reams Thin Post at	0	11
„ 20.	„ 10 Ditto Demy at.....	1	4
Dec. 1.	„ 10 Ditto hot pressed at	1	15
„ 3.	„ 12 Doz. Lead Pencils at	0	5
„ 13.	„ 9000 Slate-pens at.....	0	10
		£101	14 6

1835.		£.	s.	d.
May 26.	By Cash	17	0	0
July 13.	„ Bill.....	9	10	0
Aug. 1.	„ 6 Doz. Wine	12	0	0
Sep. 18.	„ 5 Ledgers returned.....	3	0	0
Oct. 7.	„ Cash	10	0	0
Dec. 31.	„ Balance	50	4	6
		£101	14	6

ADDITION AND SUBTRACTION TABLE.

1	2	3	4	5	6	7	8	9	10
2	4	5	6	7	8	9	10	11	12
3	5	6	7	8	9	10	11	12	13
4	6	7	8	9	10	11	12	13	14
5	7	8	9	10	11	12	13	14	15
6	8	9	10	11	12	13	14	15	16
7	9	10	11	12	13	14	15	16	17
8	10	11	12	13	14	15	16	17	18
9	11	12	13	14	15	16	17	18	19
10	12	13	14	15	16	17	18	19	20

MULTIPLICATION AND DIVISION TABLE.

Twice	3 times	4 times	5 times	6 times	7 times
2 ... 4	2 ... 6	2 ... 8	2 ... 10	2 ... 12	2 ... 14
3 ... 6	3 ... 9	3 ... 12	3 ... 15	3 ... 18	3 ... 21
4 ... 8	4 ... 12	4 ... 16	4 ... 20	4 ... 24	4 ... 28
5 ... 10	5 ... 15	5 ... 20	5 ... 25	5 ... 30	5 ... 35
6 ... 12	6 ... 18	6 ... 24	6 ... 30	6 ... 36	6 ... 42
7 ... 14	7 ... 21	7 ... 28	7 ... 35	7 ... 42	7 ... 49
8 ... 16	8 ... 24	8 ... 32	8 ... 40	8 ... 48	8 ... 56
9 ... 18	9 ... 27	9 ... 36	9 ... 45	9 ... 54	9 ... 63
10 ... 20	10 ... 30	10 ... 40	10 ... 50	10 ... 60	10 ... 70
11 ... 22	11 ... 33	11 ... 44	11 ... 55	11 ... 66	11 ... 77
12 ... 24	12 ... 36	12 ... 48	12 ... 60	12 ... 72	12 ... 84

8 times	9 times	10 times	11 times	12 times
2 ... 16	2 ... 18	2 ... 20	2 ... 22	2 ... 24
3 ... 24	3 ... 27	3 ... 30	3 ... 33	3 ... 36
4 ... 32	4 ... 36	4 ... 40	4 ... 44	4 ... 48
5 ... 40	5 ... 45	5 ... 50	5 ... 55	5 ... 60
6 ... 48	6 ... 54	6 ... 60	6 ... 66	6 ... 72
7 ... 56	7 ... 63	7 ... 70	7 ... 77	7 ... 84
8 ... 64	8 ... 72	8 ... 80	8 ... 88	8 ... 96
9 ... 72	9 ... 81	9 ... 90	9 ... 99	9 ...108
10 ... 80	10 ... 90	10 ...100	10 ...110	10 ...120
11 ... 88	11 ... 99	11 ...110	11 ...121	11 ...132
12 ... 96	12 ...108	12 ...120	12 ...132	12 ...144

£ denotes libræ, or pounds.

s, solidi, or shillings.

d, denarii, or pence.

qrs, quadrants, or farthings

¼ 1 farthing

½ halfpenny

¾ 3 farthings

CONTENTS.

ERRATA.

PROB. 1.

Page 58, for $\frac{216}{240}$ read $\frac{173}{240}$; for $\frac{4255}{4340}$ read $\frac{4255}{4840}$.

PROB. 2.

Page 58, for $\frac{18223}{5760}$ read $\frac{18220}{5760}$; for $\frac{593}{1008}$ read $\frac{594}{1008}$.

——— for $\frac{66}{256}$ read $\frac{66}{252}$; for $\frac{577}{672}$ read $\frac{588}{672}$.

PROB. 3.

Page 59, for $\frac{365}{960}$ read $\frac{233}{480}$; for 30 yds. read 20 yds.

——— for $\frac{91}{277}$ lb. read $\frac{91}{288}$ lb.

Page 60, for $\frac{1}{1928}$ read $\frac{1}{1723}$.

RULE 2.

Page 62, for $1\frac{61}{140}$ read $1\frac{13}{70}$.

Some other errors are left to be corrected by the Pupil.

Wm. Stephenson, Printer, Hull.